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THE PRACTICAL ENGINEER

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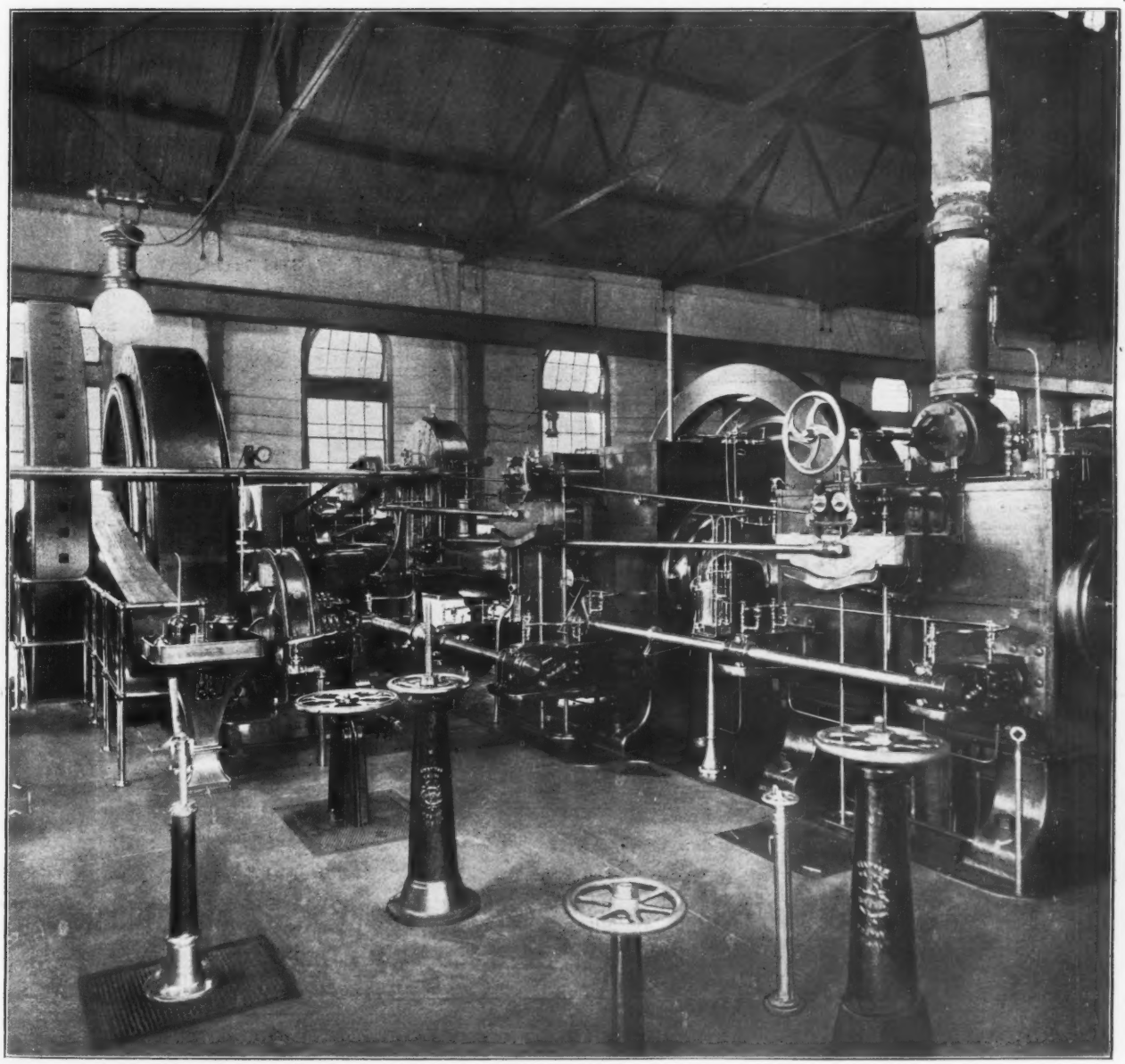

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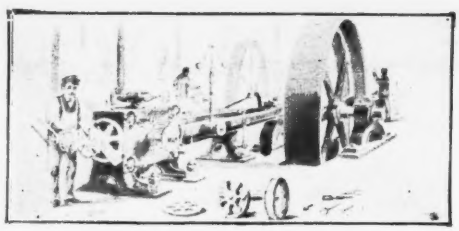

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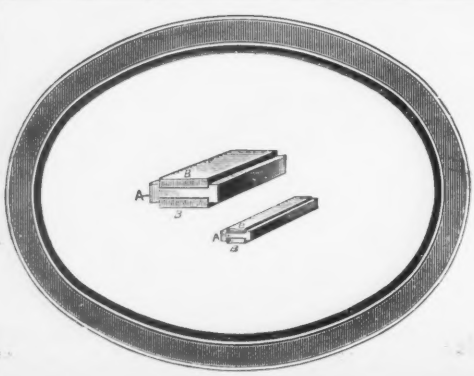

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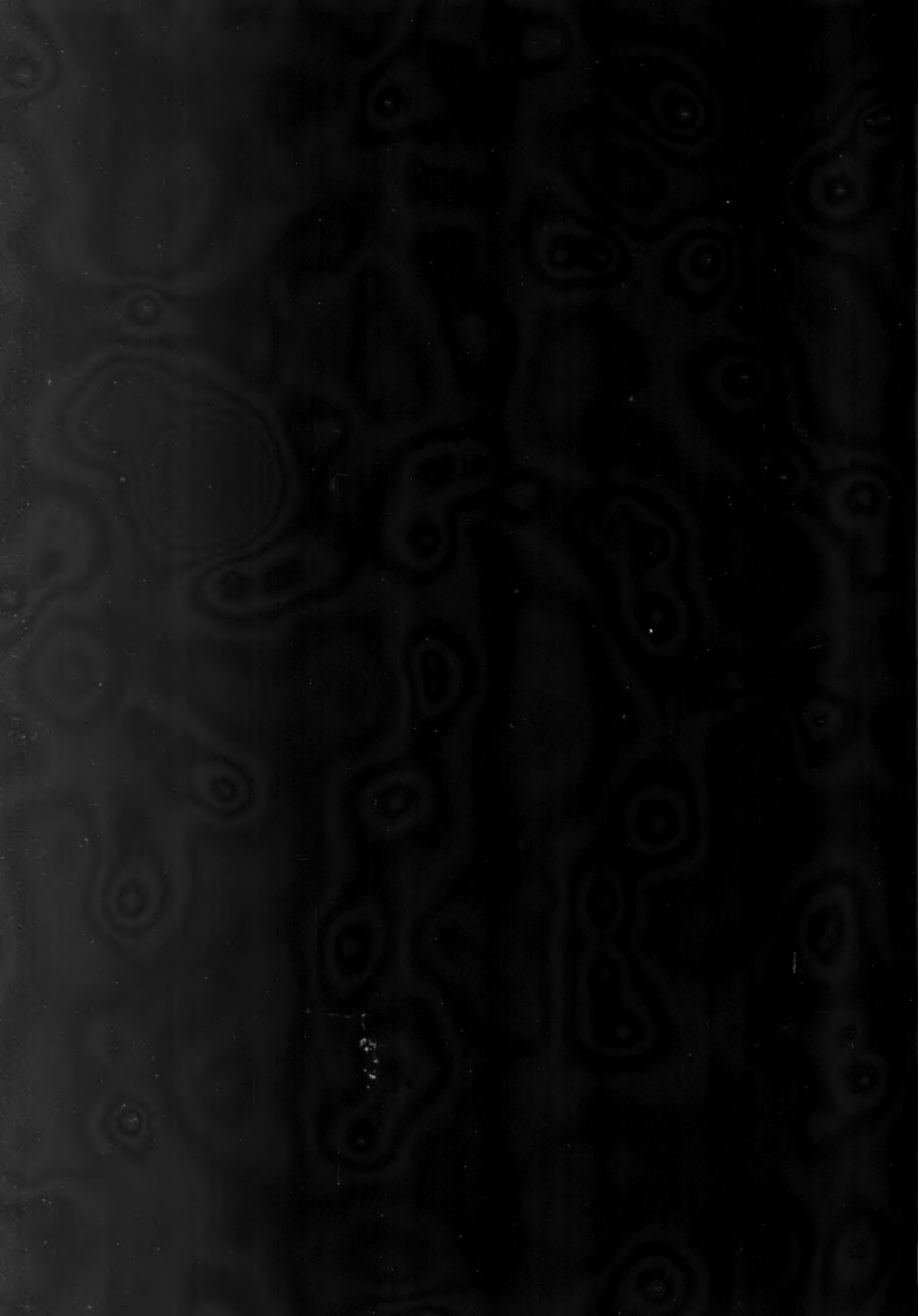

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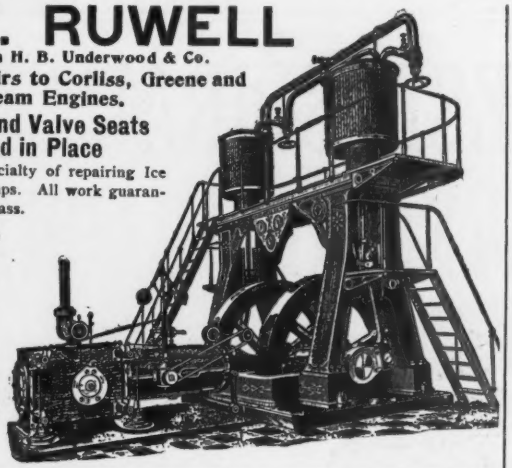

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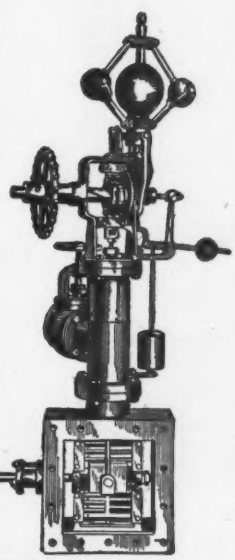

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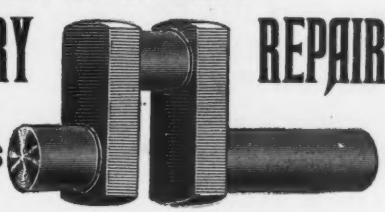

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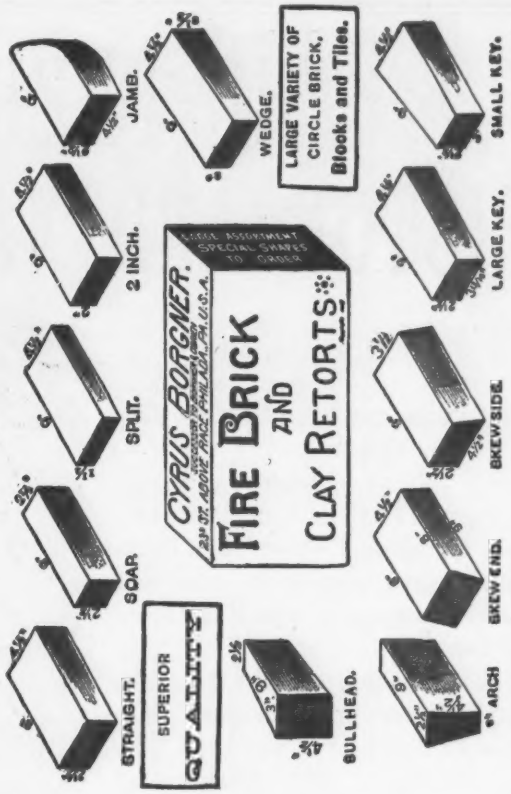

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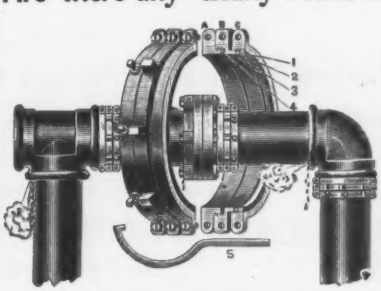

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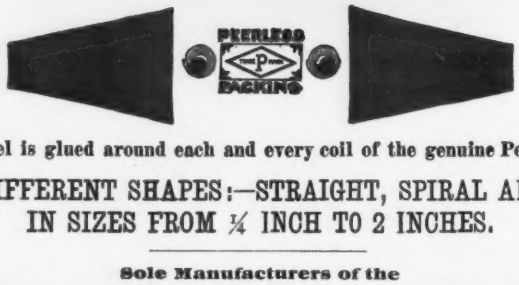

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The Practical Engineer

THE
OFFICIAL ORGAN
OF THE
AMERICAN ORDER
OF STEAM ENGINEERS

Devoted to the Interests of Stationary Engineers.

VOL. VI. PHILADELPHIA, DECEMBER, 1902 No. 11

Need of a License Law in Pennsylvania

Is life and property more precious in one section than in another? Is there any apparent reason why a law should be enacted which protects a citizen in one part of the state and not of another? Certainly not! yet we are laboring under just such an incongruous condition in Pennsylvania. In another part of this edition we publish a description of a boiler explosion in which a number of persons lost their lives, and double as many were injured, more or less. It needs but a perusal of the article to convince the most skeptical, that with boiler inspection and engineers' license laws such as Philadelphia enjoys, and as ably enforced, there would not have existed such conditions. Hence it is logical to assume that there can be no rational opposition, either by engineers or manufacturers, to the passing of a law, when our legislature convenes this winter, that will provide a measure of surety against such accidents. This particular accident is only one of several that have occurred during the past year in this state, all of which to outward appearances, would not have happened under the conditions prevailing in Philadelphia. Unquestionably all persons would be benefited by the extension of the Philadelphia law or one of similar conception. No more propitious time presents itself than the present; hence we will expect to see a united effort, upon the part of the engineers, to place before our legislators such a bill as cannot help but meet with their approval.

The officers and members of the American Order of Steam Engineers residing in Philadelphia should lend their undivided support to such a movement, for the benefit of their brother craftsmen up state, and every engineer up in the state owes it as a duty to his profession to exert his utmost endeavors in making the desired legislation an accomplished fact. Dreaming is valueless; the time for action is here.

Steam and Its Properties

Every engineer knows, to his own satisfaction at least, just what steam is, yet when it is asked that the term be defined, and its properties explained, there is difficulty at once in giving correct explanations. Of course, everyone knows that steam is a water vapor and that it possesses the property of expansion, and so in a general way, can talk intelligently of its uses and applications. But to be clear and exact at the same time is wholly different.

In the first place, steam is an invisible vapor. True, steam cannot be seen, for it is transparent. When a portion of it condenses, however, so that there is a large number of moisture particles held in suspension in the steam, then the vapor assumes the bluish-white or milky-white appearance as commonly seen in escaping from exhaust pipes. That steam is invisible may be easily and conclusively shown by the appearance of the vapor escaping from a safety valve. Very close to the valve nothing can be seen but the valve body itself. But above the outlet a few inches, at a point where the steam has had opportunity to condense somewhat, it becomes hazy, then bluish-white, and finally foam-white, totally obscuring objects by its cloudiness.

Steam exists in two forms or states. It may be either saturated steam or superheated steam, according to its pressure and temperature.

The most common form is saturated steam. It is this form which is generated in the ordinary steam boiler under the usual working conditions. It is steam which is in contact with the water from which it is generated. Therefore, the steam and the water must have the same temperature. For if the water were cooler, it would condense the steam until equality of temperature was regained; and if the steam were cooler, some of the water would flash into

steam, thus taking heat from the water and reducing all to one common temperature.

This is one of the peculiar properties of saturated steam. That is, it can have only one temperature for a given pressure. We know that water exposed to the pressure of the atmosphere alone, at the sea level, will boil at 212° F., and that the steam formed will have the same temperature. The atmospheric pressure is practically 14.69 pounds absolute per square inch, and hence we say that saturated steam has a temperature of 212° F. at 14.69 pounds absolute pressure.

If we put the water under pressure in a tightly closed vessel and apply heat, we find that its temperature will have to be raised considerably above 212° before steam will be formed. If a gauge is attached to the vessel so that the pressure can be easily determined, we shall find that as the pressure increases, the temperature of the steam increases, according to a certain fixed ratio. This relation of pressure to temperature is shown in any good table of the properties of saturated steam.

In order for the steam to be saturated, however, it is not necessary for it to be in contact with water. Saturated steam under any given pressure is always at the same temperature as boiling water under equal pressure. Hence if we take a quantity of steam and remove it from the vicinity of the boiler and out of contact with the water as, for instance, in the cylinder of a steam engine after cut-off, it still remains saturated steam, if its temperature is the same as that of boiling water under a pressure equal to that of the steam in the cylinder.

Saturated steam is of two kinds. It may be either wet or dry saturated steam. If it contains moisture globules held in suspension, then it is wet saturated steam. If, however, all moisture is evaporated, so that there is no water entrained in the steam, then it is dry saturated steam. In the latter case, any loss of heat will be followed by the formation of moisture of condensation. In the former case, a loss of heat will simply add to the moisture already present.

If, however, we take a volume of saturated steam and heat it, keeping the pressure constant, we give to each pound a greater amount of heat than it would contain when existing merely as saturated steam. Under such conditions the steam is said to be superheated. That is, it possesses a higher temperature than the boiling point of water subjected to an equal pressure. In this it is wholly different from saturated steam, since saturated steam has always the same temperature as that of boiling water under an equal pressure.

There are other differences between saturated and superheated steam which become very apparent. If saturated steam loses any of its heat, a certain amount of it condenses. When superheated steam loses heat, there is no condensation until the temperature has fallen below the boiling point of water at an equal pressure. That is, in losing heat, superheated steam first changes to saturated steam and then, upon further loss of heat, condenses. Saturated steam at a given pressure can have only one temperature. Superheated steam at a given pressure may have any one of a large number of temperatures, depending upon the volume of steam and the amount of heat added.

\+ \+ \+

A Murderous Practice

It is said that the percentage of dead and wounded among railway employees exceeds by far the casualty list of an army during war times. Presuming such to be the case, there must be something very wrong with a system that permits such a condition to exist. That the death list is not greater is due to the many laws which have been passed compelling the railway companies to install safety devices, etc., for the general protection of their men. But, there is still a field open to much needed legislation—and probably one to which is directly due more than one-half the fatalities.

In the trial of a damage suit against the New York, New Haven and Hartford Railroad in the Supreme Court before Justice Gildersleeve an astounding sidelight came out in the testimony, showing the mental and physical condition that the engineer was in and which, it was claimed, was directly responsible for the accident, a serious wreck near Long Hill, Conn., in which three men were killed, several injured and two locomotives and twenty cars completely wrecked.

The following was shown in the case of the engineer:

He had been on duty continuously for sixty-one hours.

From Friday at 4 o'clock in the afternoon, until the following Monday, at 5 o'clock in the morning, he had been constantly in the engine cab, with the exception of six hours. This he had spent in sleep. These were short naps of about an hour each.

On the Monday morning he had protested against working any longer. He declared he was not fit to run a train, but was not relieved.

In his mental daze he failed to interpret signals, and the result was that the unfortunate man lost his right hand in the smash-up.

In this instance the engineer was lucky enough to escape with his life, but usually he is a victim as well as others. In event of his death from the accident it becomes easy for the Company to place the blame upon the engineer.

In the above case the truth eked out in court, but how many cases of like nature are there of which we never hear? Undoubtedly many, for the engineer if he lives dare not say that he was asleep at his post because of having been kept for maybe two or three days and nights at continuous work; if he did, he knows at once that he will be discharged from a profession which he spent years to acquire, consequently he accepts the blame either dead or alive—dead because not one of his fellow employees dare speak a word of the real cause of the accident—and alive he accepts it because his bread and butter depends upon his silence.

This is a question which not only concerns the employees but also the traveling public as well. The strangest part of this is that the traveling public don't seem to care and the engineer, or other employee, don t dare to interfere, but there is certainly opportunity for undying fame to the Legislature who will enact a law to overcome this, one of our greatest industrial ills.

Now, while it is seldom brought to public notice, the condition of the stationary engineer is little better than that of their railway brethren. We venture to say that more than one-half the men engaged in this profession put in very close to 80 hours a week in their engine rooms. With such a condition existing it is remarkable that there is not more frequent accidents. At the best the engineers position is productive of a lethargy which is hard to overcome, because of the heat of the engine room, yet, we know that the engineer holds in his hands the safety of all those about him, hence a law determining the period of time he shall work would appear to be both equitable and reasonable.

There is probably no other class of skilled labor at the present time enjoying less of the emoluments of a profession which their own efforts in organization and education has placed upon the plane it occupies. The time was when an engineer was in act as well as fact, but little more than a laborer, but that time is in a past century. At present an engineer must be versatile upon many subjects, besides being a mechanic of a high order. Despite all this he is the only mechanic in the country whose position is unrecognized by the employer.

We are constantly hearing labor unions denounced as unfair, and we hear the employers say "if you men would come to us individually we would reward you according to your worth—but we won't recognize your union." Yet the fact remains that, the stationary engineer almost invariably makes an individual appeal, but too often in vain.

* * *

The Nature of Heat

By T. H. Reardon

Heat regarded from a scientific standpoint, is believed to be nothing more or less than a rapid to and fro movement, or vibration, of the molecules or particles of matter, of which all substances are formed. For several centuries the idea prevailed amongst scientific men, that heat was a substance, possessing materiality, was ponderable, etc., but the searching and exact methods of scientific investigation demonstrate conclusively that any such conception of heat is inconsistent and fallacious.

Heat can only be regarded as a particular manifestation of energy and its production may be accomplished in different ways, but in every instance, and regardless of the methods employed in its production, the quantity of heat produced is always in exact proportion to the chemical, mechanical or electrical cause from which it results.

The production of heat by mechanical means has served as a foundation for the science of thermo-dynamics, and while the phenomena is of the utmost importance in physical investigations, it is at the same time the matter that as a rule gives the engineer the greatest trouble, and it is also directly responsible for the endless array of lubricants each more effective than the other in nullifying its effects.

The most important knowledge that has resulted from the observation and measurement of heat produced by mechanical means, is embodied in what is known as the "mechanical equivalent of heat." This important determination was carried out for the first time by Dr. Joule in England, nearly a century ago. Dr. Joule found that the mechanical energy liberated by a descending weight and actuating paddles in a known weight of water, when the effect mechanically was equal to 778 foot-pounds the elevation of temperature occurring in one pound of water was one degree F. Since that time this determination has been made time and again by scientific men, the only difference in results being a closer approximation to absolute accuracy; the latest, and probably most correct, value obtained by the late Prof. Rowland, of Baltimore, is 772 foot-pounds are equal to one heat unit.

As the exact value of the heat unit is expressed in foot-pounds, and as the foot-pounds are readily convertible into horse-power when the element of time is included, there is absolutely no difficulty in taking a given quantity of heat and ascertaining its equivalent in H. P., or conversely taking a given quantity of mechanical or electrical H. P. and finding its equivalent in heating effect. The production of heat by chemical action (which includes ordinary combustion) is in its nature not very different from the production of heat in a mechanical way. In this case the ultimate particles of the substances that unite with each other in burning, have a very powerful attraction for each other, and when the temperature is sufficiently elevated to render combustion easy, the particles rush together, and it is the collision and impact of the particles that gives rise to the phenomenon known as heat; in the collision of larger bodies heat is produced in an exactly similar manner.

Electrical heat has much more to commend it, leaving out the question of cost; it will undoubtedly interest some of the readers of "The Practical Engineer" to compare the relative cost of heating by electricity and of heating directly by burning coal, making the comparison on the heat unit basis, as outlined in the above.

* * *

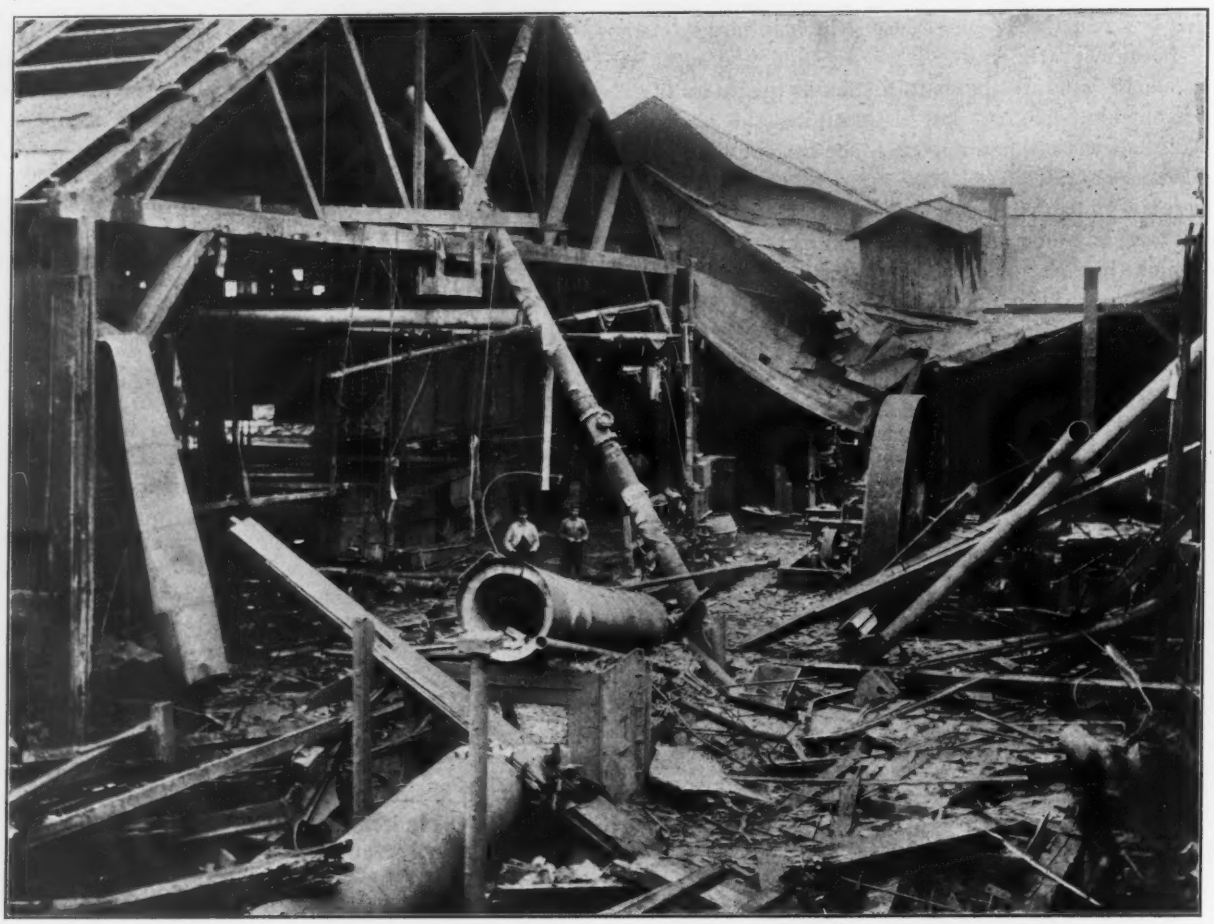
A dispatch from Indianapolis says that Emmet Greenfield, a moulder employed at Evansville, says that he has discovered an energy which will revolutionize mechanical power and solve the problem of fuel and heat for all time. By a simple device like an electric battery, the construction of which remains his own secret, he says he can extract energy from the rays of the sun and transmit it to motors for mechanical power or to stoves and furnaces for heat. He says he has a successfully working model of the battery, which is especially adapted to producing intense heat for smelting purposes.

A Disastrous Boiler Explosion at Lebanon, Pa.

The thirteenth day of November last was truly an unlucky day for the town of Lebanon. A catastrophe unequaled in the annals of the town occurred on that date, dealing death, ruin and misery in its wake. The disaster was caused by the explosion of a 250 horsepower boiler in the west works of The American Iron & Steel Company. Three men were killed outright and nine others died from their injuries during the next twenty-four hours succeeding the bursting of the boiler. Words cannot depict the scenes enacted at such a time—the horror of a boiler explosion can only be appreciated by an eye-witness. The disaster comes with the speed of lightning, only less merciful, and with force equal to a hurricane. At the time of the accident, 3.30 P.M., the first night-shift had just come on and were making ready their work when, without a note of warning, there was an ear-splitting concussion which shook the mill to its very foundations and caused the earth to tremble as with a violent earthquake. Simultaneously there came a deluge of hissing steam which gathered up the dust and dirt of the mill and carried it to the faces and bare bodies of the millmen, where it stuck while scalding steam boiled the skin loose from the flesh. But this was only the beginning. Horror piled upon horror. Before the terror-stricken men could recover their scattered senses the roof of the mill, weakened by the breaking of supports by the flying boiler, fell down upon them, burying many in piles of charred wood, shafting and old iron. Some were pinioned in the mass, and they mingled their shouts for help with the bleeding ones beneath. The exploding boiler was one of eleven of similar type in that portion of the mill, each being a straight cylinder 28 feet by 44 inches, set in a brick casing over puddling furnaces. It will be understood that the boilers are placed thus to utilize the waste heat from the furnaces, after it has been used to work the iron, for steam-making purposes; the steam generated in this manner is in turn used to operate the squeezer engines and other machinery of the mill.

The boiler which exploded parted almost in the middle, one portion flying with awful force through the mill, partly wrecking it, and finally ending up against a pile of iron scrap. The other end took an upward shoot, something on the style of a rocket, with a graceful curve passing through the roof of the adjoining mill, then passing entirely over another building, striking against a bank fifteen hundred feet from the original foundation. The head of the boiler then tore loose from the shell and passing over the bank, crashed through a bill-board some fifty feet further on.

The accompanying illustrations will give an idea of the havoc created.



SHOWING WHAT IS LEFT OF BOILER SETTING AND FURNACE. IN THE BACK-GROUND A SIMILAR BOILER CAN BE SEEN PRACTICALLY INTACT

The cause of the explosion was, without doubt, due to disintegration of the metal from the external side of the boiler—in some cases the wasting away having reduced the shell from 5-16 inch, its original thickness, to but little more than ⅛ inch. In other places the iron showed pronounced cases of crystallization—so much so that in places, a blow of a hammer would crumble it.

Mr. James Lord, general manager of the mills, stated to the writer that they knew the boilers were old and were replacing them with new ones as fast as they conveniently could, irrespective of their possible worth. They had depended, however, upon the insurance inspector's report as a safeguard. The boilers were inspected by a leading boiler insurance company a few months previous, and permitted 80 pounds of steam in their report.

It seems incredible that a competent inspector should fail to detect some of the defects in this case. The point at which the shell parted showed a crack of over 15

THE SPOTS ON THE SHELL IN THE FORE-GROUND ARE RUST MARKS, SHOWING HOW BADLY IT WAS WASTED AWAY.

inches in length, which had evidently existed some time previous to the explosion—just how long is, of course, problematical.

One of the very commendable features of this case is the evident desire, upon the part of the steel company, to assist in every possible manner in placing the blame in the proper place. There has been no cry of low water, or neglect on the part of the attendant, etc., such as there often is in like cases. Every means has been placed in the coroner's hands to insure his giving a correct diagnosis of the case.

This case is only another instance forcibly illustrative of Pennsylvania's crying need of a boiler inspection and engineers' license law, similar to that now in force in Philadelphia, and together with the disastrous explosions at Pittsburg last spring and others, it should furnish the engineers who advocate such a law with an effective argument when the next legislature convenes.

The How and Why of the Condensing Engine

By T. Duncan Just

Condensing engines were among the very first type of steam power producers used. In fact both James Watt and Newcomen used condensers in connection with their engines, the steam being used only to raise the piston—the return stroke being caused by creating a vacuum in the cylinder through means of an injection of cold water into the steam, the atmospheric pressure then acting with almost its full force against the piston on its downward stroke.

After a time Watt invented the two-valve system—that is, a means of using steam for both the upward and downward stroke. This was found so much more practical that the old system of condensing was almost forgotten for a time. Later on it was realized that the condenser could be made a very economical adjunct to the present type of engine, and it is now used in various types upon almost all the larger engines of recent make.

In spite of the simplicity of the condenser and the period of time in which it has been used there are still many engineers who—and some who are running condensing engines—do not understand it, only in a vague way; hence a lucid and untechnical explanation of the condenser will not be amiss.

It is understood that the atmosphere exerts a pressure of fifteen pounds per square inch—or very nearly—on all surfaces with which it comes in contact. Now this air is in contact with the open side of an engine piston and consequently the steam in pushing the piston forward has to force back this fifteen pounds pressure of the atmosphere.

The useful force of steam is therefore, whatever pressure there is above the weight of the atmosphere and this is the pressure that the steam gauge shows. When the gauge says 60 lbs. we really have 75 lbs., but 15 lbs. of it does not count, because it is balanced by the atmospheric pressure on the other side of the piston. If we had sixty pounds of steam pressing on the piston and could get rid of the atmospheric pressure on the outside of the piston, the steam would exert a force of 75 lbs. per square inch, a very respectable gain, indeed. Of course, we might remove the air pressure by pumping it out, but the amount of power required in doing the pumping would be equal precisely to all the gain hoped for, plus the friction of the pump; therefore, there would be an actual loss in the operation. But there is another way of removing the air pressure. It is generally understood that a cubic inch of water vaporizes and expands into a cubic foot of steam at atmospheric pressure. If, after getting this cubic foot of steam, we take the heat out of it, we again turn it into a cubic inch of water. Assume the engine cylinder is to hold just a cubic foot of steam, and assume that the stroke is complete and ready for the exhaust valve to open and permit this foot of steam to escape, now assume that this cubic foot of steam has expanded down to atmospheric pressure, that is, 15 lbs., absolute pressure. Now, instead of opening the cylinder to the atmosphere, we dose the cylinder with cold water. The heat leaves the steam and goes into

the water and the steam turns into water, leaving in the cylinder the condensed steam in the form of a cubic inch of water. The steam formerly filled the cylinder, and now it fills but a cubic inch of it, consequently, we have produced in the cylinder a vacuum which has the effect of adding about 15 lbs. per square inch, to the force of the steam on the other side of the piston, by virtue of removing that much resistance to its forward motion. The heat which was in the steam has gone into the condensing water, except the trifle that remains in the cubic inch of condensed water. We must get this condensed water out of the cylinder, and it will be an advantage to pump it back into the boiler, for it is pure and also hot.

This is the general principle of the condensing engine. It gives us the grand advantage of a heavy increase in

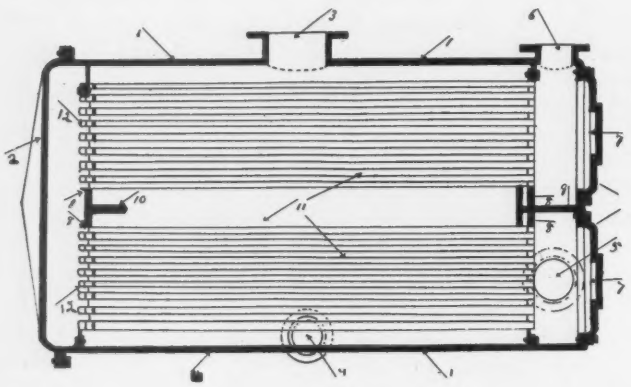


FIG. 1

the useful pressure acting to push the piston forward; it gives us pure water for use in the boiler, and it saves in the feed-water the heat that would otherwise go out o the exhaust pipe. But it is not practicable to condense the steam in the cylinder by dosing the cylinder with cold water. In practice, the steam is allowed to go into a separate condensing vessel, called the condenser. The condenser is precisely the opposite of the boiler. The boiler is the appliance for putting heat into the steam to vaporize it, and the condenser is the appliance for taking heat out of the steam and turning it into water again. In the condensing engine, one of these machines is pushing on the piston and the other machine is pulling on it.

The gain by condensing is so great that it is a profitable piece of business to apply a condenser to any large non-condensing engine. The condenser requires a pump to withdraw the water of condensation, and this pump must be in reality an air-pump. In practice, they employ an air-pump and condenser combined in one structure, separate from the engine, and driven either by rod connection from the engine, or by a belt from the engine, or by an independent steam pump. The arrangement will depend much upon the situation. The belt-driven pump permits of the condenser being set in any convenient position independent of the engine.

Condensers are classified into two divisions—surface and jet condensers; again these are divided into direct connected and indirect connected condensers.

The surface condenser—see figure 1—is mainly used in marine practice because it gives a better vacuum and keeps the cooling water separate from the condensed steam, thus permitting, where salt water is used for cooling purposes, the use of the condensation without danger of contamination. It consists of a vessel, of varied shapes, through which a number of tubes—usually brass or copper—are passing. The ends of this vessel are closed by double heads; into the inner one on one end the tubes are expanded, passing with their other ends through stuffing boxes in the inner head on the opposite head. This permits of expansion and contraction without danger of leakage. A study of the following list will give a thorough understanding of this appliance. Figure 1: 1 is the condenser walls; 2, the outside heads; 3, the exhaust inlet; 4, the exhaust outlet; 5, the water inlet, 6, the water outlet; 7, peep holes; 8, tube heads; 9, partition; 10, rib; 11, tubes; 12, stuffing boxes.

The cooling water is passed through these tubes by means of circulating pumps, while the steam entering the vessel and coming in contact with the cool tubes, condenses; the water of condensation and the remaining air are removed by means of an air-pump and discharged into a hot well, there to be used for whatever purpose desired.

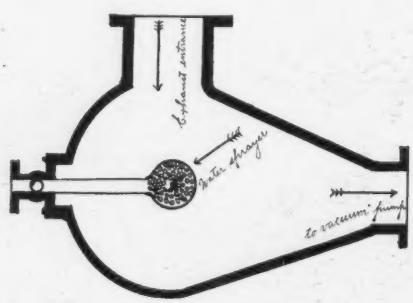


FIG 2

Figure 2 shows a type of condenser much cheaper and more commonly used on land than that shown in figure 1. It is called the jet condenser. It is simply a chamber into which the steam exhausts from the engine and into which a jet of cold water is sprayed, thus condensing the steam, after which process the condensed steam and water are removed by means of the air pumps

Of course there are various types of condensers, but the above very nearly describes them all as far as practical results go.

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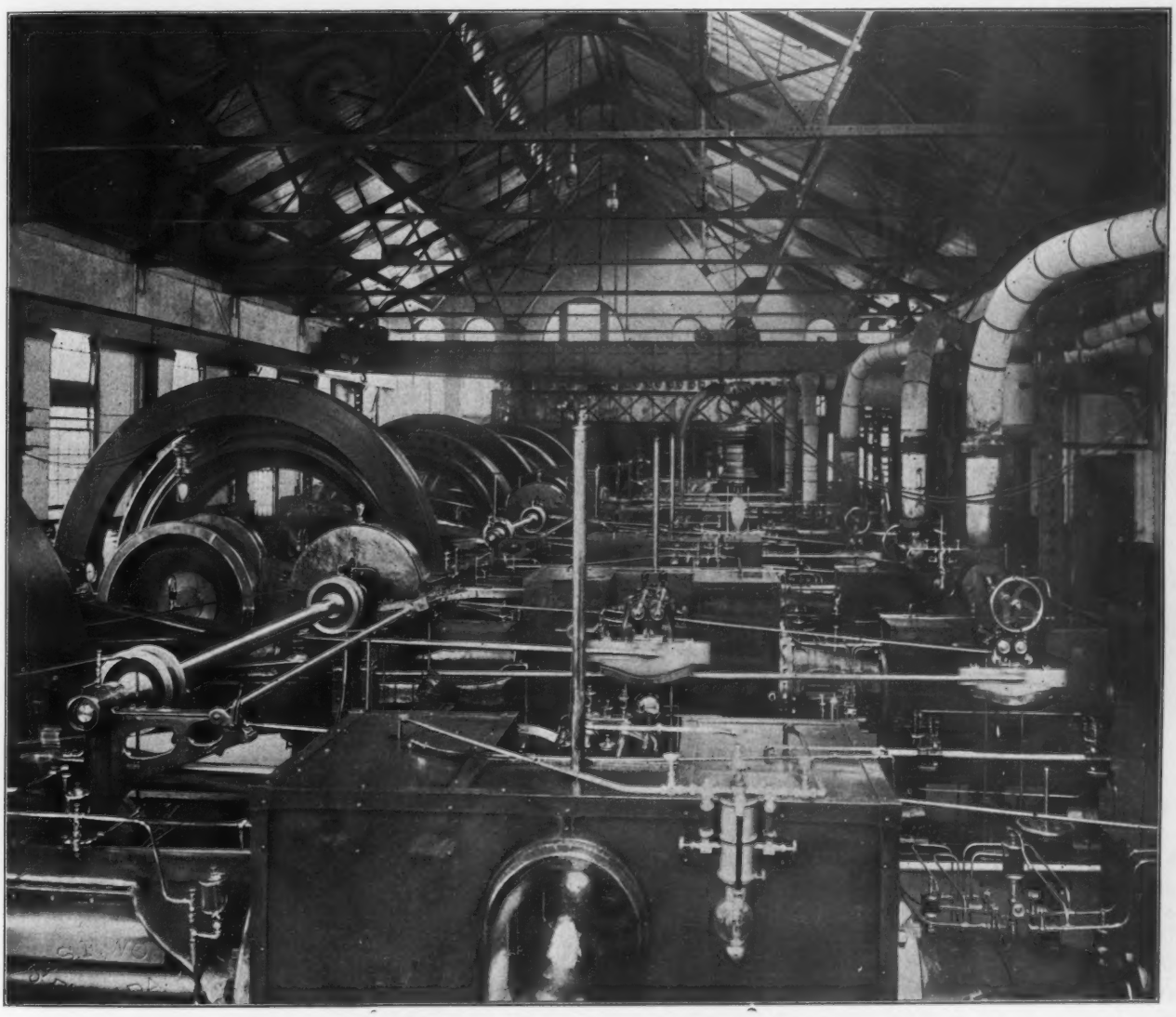
The Board of Naval Engineers appointed to examine into the merits of oil as a fuel instead of coal have arrived at the determination that it cannot compete with coal for naval uses. Fourteen different devices presented by American inventors for tests were tried, but it is said that not one of them would burn oil under a naval boiler in competition with coal even with the oil at a cost of $1 per barrel.

Philadelphia Electric Company

CALLOWHILL STREET STATION

Situated on the East bank of the Schuylkill River, at 26th and Callowhill Sts., in the handsome building originally erected as a power house for The Hestonville, Mantua and Fairmount Railway, is one of the most interesting lighting plants in Philadelphia, and but one of the numerous plants operated by The Philadelphia Electric Co.

Unlike other plants, practically none of the current generated at this station, is used directly for lighting, excepting in and about the station itself, but is distributed at its initial voltage of 5,500 by means of underground cables, to numerous sub-stations throughout the city, (the majority of which, by the way, were formerly generating plants) where the voltage is reduced by transformers to 2,000 volts for local distribution.



INTERIOR OF PHILADELPHIA ELECTRIC COMPANY'S CALLOWHILL STREET STATION

Steam is furnished by eight boilers of the Babcock & Wilcox type, two of which are of 400 H. P. rated capacity, each having two 42 inch drums and a bank of nine four inch superheating tubes. The remaining six are of 500 H. P. rated capacity, each having three 42 inch drums and two banks (six each) of superheating tubes 4 inches diameter by 23 feet long. The boiler tubes are 4 inches diameter x 18 feet length. Steam pressure is carried at 165 lbs. per square inch.

The boilers are hand fired, bituminous coal being at present in use and will likely continue to be used owing to the plant being already overloaded.

Two Buffalo fans, direct driven by auxiliary steam engines, and located one at each end of the boiler room, supply forced draft for the furnaces when anthracite fuel is used.

Fuel is delivered to the station by boat, from which by means of a link belt elevator and conveyor, it is transferred to storage bins of 1,800 tons capacity located at an elevation beside, and running the length of the boiler room. From this bin the coal is delivered by chutes directly in front of each furnace.

The average coal consumption is about 65 tons per 24 hours.

In the engine room are two twin, tandem-compound improved Green engines, with cylinders 17½ and 33

inches diameter by 48 inches stroke, cranks coupled at 90 degrees to each other on shaft, and running at 102 revolutions per minute. One half of one of these sets is shown in illustration on front cover.

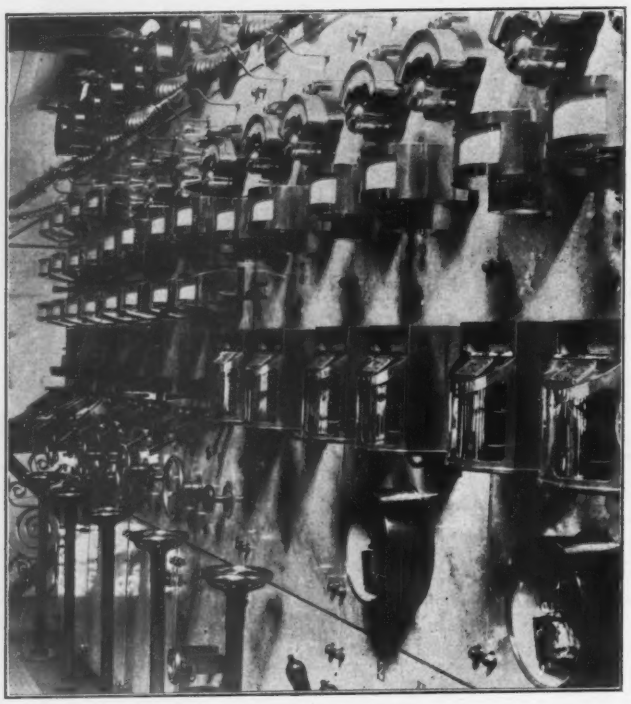
These engines have each been recently fitted with cast steel crossheads and solid end connecting rods, with wedge adjustment on both ends.

Both rods and crossheads have been made considerably heavier than the originals.

In place of the usual Porter type of governor, a Rites governor is used, driven direct from the crank shaft by two belts.

Each engine has a fly wheel 18 feet in diameter, the rim weight of which is 64,000 lbs.

In addition to these, are two cross-compound Corliss engines, cylinder 26 and 54 inches diameter by 42 inch stroke, built by the Pennsylvania Iron Works Co.



VIEW OF A PORTION OF SWITCH BOARD.

These engines are equipped with double eccentrics on both high and low pressure side, and steam actuated dash pots are used in place of the usual vacuum pots.

The governors on these engines are of the flyball type and driven by bevel gearing instead of belting.

The flywheels are 18 feet in diameter with rim weight 85,000 lbs.

The low pressure cylinders are equipped with a throttle valve and connected with the steam main through a reducing valve set at 35 lbs., by means of which, in cases of accident to the high pressure side, the engine may be driven by the low pressure cylinder at a capacity of about one-half load.

Four Wheeler surface condensers, one for each engine, take care of the exhaust, these in turn being cared for by two Knowles' combined air and circulating pumps, the steam cylinders of which are compounded. Part of the condensing water is fed into the boilers after passing through two Cochrane heaters by means of two Worthington duplex steam pumps; an auxiliary duplex pump of same type being held in reserve for feed, fire or general service as may be required; the exhaust from pumps is utilized in the heaters.

On the crank shaft of each engine is mounted a 72 pole revolving field of the General Electric Co.'s two phase generator with a capacity of 1,000 K. W. at 5,500 volts.

The field of each generator is supplied with current from a 30 K. W. General Electric Co's., multi-polar exciter, shunt wound, operating at 125 volts and belt driven direct from a pulley on the crank shaft.

In addition to these is a 50 K. W. Siemens-Halske exciter direct connected to a 10 X 12 Armington and Sims engine, running at a speed of 340 revolutions per minute, which may be used in case of accident to any of the regular exciters.

The generators are operated in parallel, synchronizing being effected from the gallery by means of electrical mechanism for controlling the governors of the engines.

The main switchboard, located on a gallery at one end of the engine room, consists of 4 generator panels and 9 feeder panels, all of gray marble.

On the top of each generator panel are located the exciter instruments; the panel proper containing ammeters indicating Watt meters, volt meters and two rheostats, one in exciter shunt field and one in the field circuit of generator.

On each feeder panel is an ammeter, indicating Watt meter and recording Watt meter for each phase.

Below the instruments on each panel is the mechanism for operating the type K. General Electric Co's., combined oil switch and circuit breaker, each panel has 2 circuit breakers, one for each bus. The bus bars are in duplicate and are located on the main floor under the gallery. In the basement, directly beneath these, is the transformer gallery, containing the meter transformers, arranged in two rows, under which are the transformers, fuses and lighting arresters.

From the end of this gallery the main distributing cables are led to the under-ground conduit.

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Smokeless Burning of Soft Coal

For years the prevention of smoke from boiler fires has attracted the attention of the engineering public. In fact, the many patents taken out for appliances for this purpose would take volumes to describe. In some cities, the smoke nuisance has been the cause of special legislation, tending to subdue the evil from a healthful standpoint irrespective of fuel saving or loss. Smoke abatement exhibitions have been held in almost every large city with more or less success. The use of bituminous coal has, during the past few months, predominated over the anthracite variety owing to the scarcity of the latter article, because of the strike. Many of those who have been compelled to use the soft coal are now loth to return to anthracite, hence, there is considerable interest being displayed in defining a reasonable method of preventing the smoke nuisance.

Smoke being the result either of an insufficient supply of air or an excessive supply at a low temperature, it is extremely difficult, in consequence of the nature of the fuel ordinarily employed in this country, to suggest a plan which shall be applicable to the volatile portion of the coal and also the coke which remains on the grate.

Smoke is produced in greatest quantity on the addition of fresh fuel to the red-hot coke on the grate, and is due to the process of dry distillation, which immediately takes place, evolving a large portion of gaseous matter from the coal, which there is either not sufficient air fully to consume, or the flame of which is cooled so much by contact with cold surfaces or cold air, as to cause a deposition of solid carbon. The prevention of smoke does not, however, necessarily prove perfect combustion of the fuel; as, if smoke be prevented by greatly limiting the supply of cold air, which may sometimes be done, a large portion of the active power of the coal may ascend the chimney in the form of invisible carbonic oxide, which, from deficiency of oxygen, has escaped conversion into carbonic acid. The analyses of the gases escaping by the chimney will, however, prove whether this be the case or not. On the addition of fresh fuel, an additional supply of hot air is required to consume the volatile products which immediately escape from it, and it is this necessary irregularity, or intermittent nature of the supply, which is so difficult practically to regulate.

Wood and turf may be burnt in a manner so as to reverse the ordinary position of the flame, as is the case with the fires in potters' kilns; this arrangement greatly tends to prevent smoke.

A bridge in front of the flame is sometimes employed with indifferent success for the same purpose.

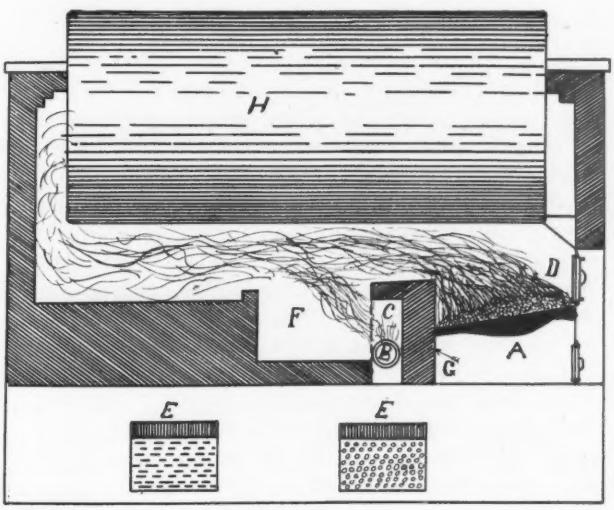


FIG. 1

Watt first suggested the idea of introducing a current of cold or hot air into the flame to prevent smoke, and a plan for carrying this out was patented by Robertson. The idea has since been practically applied in a great variety of ways; the air has been conducted in flues by the side or under the fire, or in the chimney, to the back of the grate, and there allowed to come in contact with the flame. The following two plans are illustrations of this principle.

The patent of the late Mr. C. Wye Williams consisted essentially in admitting a current of air behind, or through the fire-bridge, in several small jets or streams, so as readily to mix with the mass of heated hydro-carbons in their escape from the fuel on the grate bars. Fig. 1 shows the manner in which this plan was adapted to a boiler-fire: h. represents the boiler; d. the fire-door lined with fire-clay; a. the ash-pit, whence the coke on the fire-grate obtains its supply of air; g. the fire-bridge, behind which is an iron box c. pierced with a number of

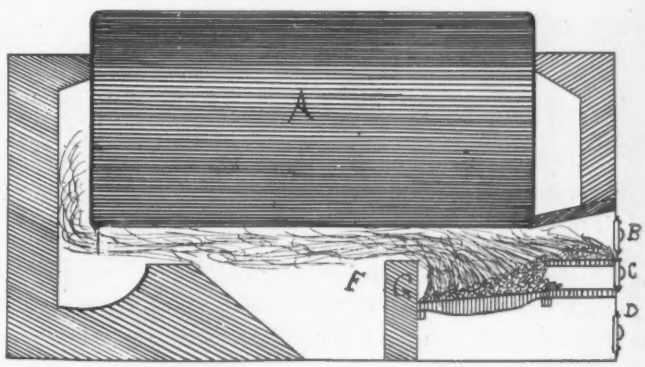


FIG. 2

small holes, through which the air streams from a tube b. communicating with the outside; ee. shows plans of different arrangements of the perforations in c. The space f. is intended to act as a diffusion chamber for the more perfect mixture of the air and gases.

Messrs. Howard & Co. adopted the plan indicated in Fig. 2, which represents a sectional elevation of the boiler and fire arrangements, where a. is the boiler, b the feeding door, c. door for removing the scars,etc., d. the ash-pit door, through which the admission of air is regulated by slides, another door, which is not shown, regulates the admission of air to the posterior part of the fire-bridge g. The coking plate h. must be built of fire-brick or stone. The coal is first coked on the above plate, and then pushed over on to the grate bars, where there always exists a bright surface of burning coke.

The gases generated in coking a fresh portion of coal pass over this heated surface before they come in contact with a fresh supply of warm air at f, and thus an almost perfect combustion of the smoke is obtained.

The saving in fuel effected by these plans varied from one-quarter to one-half of the whole generally used at that time, and they consequently attracted a good deal of attention. Although a very beneficial result would follow the previous coking of the coal on a broad plate made of stone in front of the fire, and the admission of a fresh supply of air at the back of the fire-bridge, there is no doubt that the only thoroughly satisfactory solution of the smoke question is to be found in the use of gaseous fuel.

Double fires were also invented by Watt, in one of which coke was burned, while the flame of the other, consuming coal, passed over it, or the two were alternately charged with coal, and by means of dampers the flame from the last charge carried over that which had become converted into coke.

Progress Real and Imaginary

By W. H. Wakeman.

No reader of this, or any other mechanical newspaper, finds more pleasure in noting improvements made from time to time, and duly reported, than the writer, but occasionally there appears one or more statements, made in one paper, and copied, or perhaps translated with more or less variations, into others, that appears to give the idea that we are making more progress than we really are, and to these I object, hoping to make my objections plainly understood.

The mechanical papers seem to be available to everybody wishing to advance an idea, and usually the editor disclaims all responsibility for them, as the author's name appears in connection with said articles.

This being the rule, I expect to be held responsible for ideas here expressed, and am willing to abide by the rule.

The statements, apparently made in good faith, which claim that we have outgrown the conditions under which the term "boiler horse-power" was born, is well calculated to give the casual reader an idea that more progress has been made than the facts really warrant.

We are told that the evaporation of 30 pounds of water per hour from 100° into steam at 70 pounds, was all right once, but is all wrong now, on account of advancements made. My claims are that the term is just as good now as it ever was, that the conditions then and now are not so different as some writers would have us believe, and if they change enough to meet the expectation of the greatest enthusiast among us, the term "boiler horse-power," as it now stands, can still be used with both pleasure and profit.

It is just as good now as it ever was, because it is an arbitrary rating fixed by competent judges who knew very well that it could not be applied to engines with the same degree of satisfaction as to boilers.

The horse-power of an engine is 33,000 foot-pounds per minute, but that is an arbitrary rating. If it had been stated at 30,000 or 35,000 it would have answered every purpose just as well (provided everybody used it) as 33,000 does now. The same reasoning applies to the boiler horse-power, for if changed to 25 or 35 pounds, it would not strike an average any better than it does now, and if it was repudiated altogether it would leave us without any standard for intelligent comparison, until somebody invented one, and even then there would be just as much objection as there now is to the 30-pound basis.

Let us give some attention to the claim that conditions are very different now from those existing in 1876, when the standard was adopted. We are told that the average pressure used was then about 70 pounds, but that from 100 to 200 is the rule now. In 1876 there were many boilers in use that carried more than 70 pounds pressure, and at the present time there are very few stationary boilers carrying 200 pounds, or anywhere near it. Thousands of boilers are used for power purposes that carry from 70 to 90 pounds pressure, and thousands more are used for heating, carrying from 5 to 30 pounds pressure, and to all of these the term "boiler horse-power" applies with equal and intelligent significance, as it is a very easy matter to reduce any pressure to an equivalent of 30 pounds.

Some engineers appear to believe that in 1876 the feed-water heaters raised the water to 100° more or less, but they are obsolete now, as better ones have taken their place. This is a mistaken idea, for there were many in use at that time which raised the water to 212° Fah., and no improvement has since been made in this respect. On the other hand places can be found where these heaters were taken out and those substituted, which seldom or never reach 200° Fah. This is not a theory but a condition with which we have to deal.

The reason for this change is found in the fact that with these old heaters in use, there was no way to prevent the tallow or oil used in the engine cylinder from going into the boilers, and this was a serious objection. If separators had been brought to their present state of perfection, and their merits were as fully appreciated, many of these old heaters would still be in use, for they did work which has never been surpassed.

Another point in favor of these old heaters is, that some of the exhaust steam was condensed in them, resulting in water that possessed no scale-making impurities, whereas, the closed heater in present use allows all water resulting from the condensation of steam to go to the sewer, and calls for a full supply of water that may form much scale. Therefore, so far as these points are concerned, we have made no progress in feed-water heaters.

Suppose that the average pressure carried on all boilers at the present time is 125 pounds, how much difference does this make in calculating boiler horse-power? It is well known that when calculating equivalent evaporation and boiler horse-power, we base the results on the total heat of steam at stated pressure. The tables differ slightly in this respect, but it will answer our purpose to take the total heat of steam at 70 pounds pressure at 1,178 heat units, and for 125 pounds it is 1,189 heat units above 32° Fah. This makes a difference of 1 per cent. in the calculation, but from the way in which it is usually presented, without explanation, we would naturally think that the difference in results was equal to the increase in pressure, which the above explanation shows to be far from correct.

I sometimes wonder if writers who present the matter in this light, really do not understand that the increase in pressure has so little effect on the calculation, or if they simply overlook it. This small difference for a great increase in pressure is due to the fact that as temperature or sensible heat and pressure increases, latent heat decreases, making the total heat much nearer alike for all pressures than the casual reader deems possible.

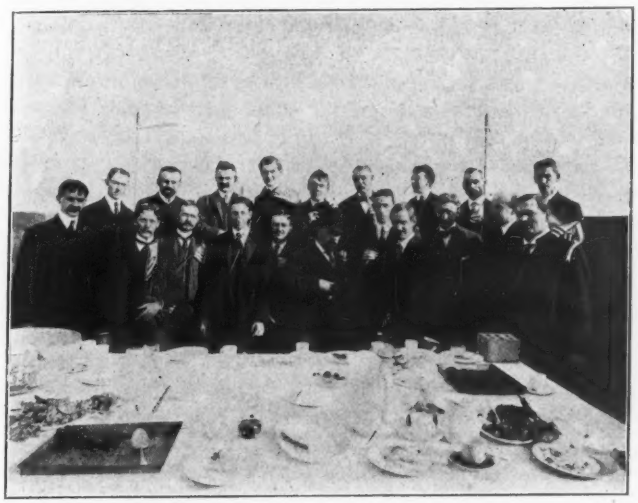
Furthermore, if the time ever comes when everybody is obliged to carry 200 pounds pressure, the total heat will then be 1,200 heat units per pound, and this is only 22 heat units more than it is for 70 pounds, making a difference of less than 2 per cent., which is not enough to cause alarm. If it is possible to give us a standard that will fit every case, let us know what it is that we may adopt it without further discussion, but if this cannot be

done, and it is necessary to make some simple calculations in order to apply any other standard that can be devised, then we might as well continue to use the old one, and thus save complications, which only confuse and disgust the average engineer.

Luncheon in the Mouth of a Smokestack 275 Feet Above Ground

Two hundred and seventy-five feet above ground, in the mouth of a smokestack higher than any other in Pennsylvania, a party of Philadelphia's business men took luncheon the other day.

With a temporary platform, which from time to time creaked ominously, as the only thing between them and



LUNCHEON PARTY AT TOP OF 275 FOOT SMOKE STACK.

Among the party are such distinguished men as follows: Joseph B. McCall, Wm. F. Harrity, W. H. Johnson, Wm. C. L. Eglin, H. J. Verner, Jos. G. Lester, John T. Windrim, Alphons Custodis, Dr. Juris Hugo Thalmessinger, Conrad Worms, E. A. Fisher, T. S. Clark, W. S. Tatnall, John R. Wiggins, S. K. Worley, Lieut. F. T. Chambers, Isaac Hetzell, Franklin M. Harris, H. E. Passavant, John F. Rowland, W. W. Atterbury, Henry Hill, Chas. Dougherty, Jas. Christy, R. J. Davis, Robert Wetherill, Richard Wetherill, Theo. Spencer, Philip Spaulding, W. S. Twining, G. C. Schoff, Geo. H. Taber, Jr., H. V. Loss, Carl H. Satherberg, A. W. Gibbs, J. M. Whitam, Wm. Henderson, A. H. Manwaring, Geo. F. Peiffer, Thos. Sproule, J. D. Whitney, W. Nagle, Geo. Evans, foreman; Geo. Ross Green.

the earth which could not be seen looking down the pitch-dark chimney, they laughed and joked merrily, while they ate chicken salad, fried oysters, sandwiches and drank large quantities of coffee and claret lemonade.

They all agreed that it was the oddest of luncheons, and appeared sad when they thought that from the place where they ate vast volumes of smoke will soon be pouring fourth.

The stack on which the curious luncheon was held is located at Christian Street Wharf, on the Schuylkill, and was erected for the Southern Electric Light and Power Company. It is built entirely of radial firebrick, and, with its height of 275 feet, has an interior diameter of 23 feet at the base and 18 feet at the top, making it capable of carrying off the smoke of furnaces generating 50,000 horse-power, which is a job few chimneys in the country could handle.

Three months ago when the work on the stack was started, William C. L. Eglin, the engineer representing the company, being somewhat uncertain that the builders would complete their work on time, offered a dinner for them and their friends as an extra inducement.

When the time came for the luncheon, the guests assembl.d at the base of the stack.

The upward journey's terrors were succeeded by a good meal, and an excellent view of the surrounding territory. Trouble arose when it was discovered that no knives or forks had been sent up by the chef. It resulted in a long discussion between a man at the top and another at the bottom.

"Hi, send up knives and forks," the man at the top shouted.

Down below, 275 feet in the distance, the message sounded like a call for more sandwiches.

Five or six things were sent up before the desired articles arrived.

When they did, the meal proceeded pleasantly again, although one man at the end asked for something he couldn't have. He thought he might get a stray cloud for a napkin.

Soft Coal and the House Furnace

According to practical engineers and firemen, men who have had experience with both fuels, soft coal can be used with absolute safety in both ranges and heaters if ordinary intelligence is displayed in the management of the fire.

A Philadelphia engineer, who, during the past few days, has been experimenting with soft coal both for cooking and heating purposes in anthracite range and heater, says the results secured by him have been thoroughly satisfactory. "It is," he says, "only a question of the proper manipulation of the draughts. In order to secure the best results the draughts in the doors below the fire-box should be kept closed, while the 'butterfly' or slide in the fire-door should be kept partially open so as to admit sufficient oxygen to consume the carbon. If this is done there will be little or no black smoke, and scarcely any accumulation of soot in the flues.

"Under no circumstances should the chimney damper be closed, for if you close it gases will accumulate and may cause an explosion, while the house is most likely to be filled with noxious vapors.

"The same rules served for caring for a fire in the range would apply for the heater, only greater care should be exercised to prevent the accumulation of gases. A bituminous fire should not be stoked from the bottom, but after being lighted it should be allowed to crust and this crust broken from the top. A fire can be kept over night by covering it with fine coal that has been dampened, with a small opening left in the centre for draught.

"While any grade of soft coal may be used in an anthracite grate with experience and care, what is known as picked coal will be found best adapted for domestic purposes, and in ranges, especially, will give the most satisfactory results."

Probably the greatest difficulty that will be experienced by the average householder in changing from anthracite to soft coal will be in impressing upon servants the necessity of closely watching the fires and giving proper attention to the draughts. Filling the fire-pot of a range to the lids with soft coal will not give good results, and attempts to broil over fresh fuel will not meet with much success. One thing that should be remembered is that soft coal ignites very rapidly, dies down with equal quickness, and needs constant watching and frequent replenishing in order to maintain a constant, even fire.

The Practical Engineer.

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AMERICAN ORDER OF STEAM ENGINEERS
NEWS OF THE COUNCILS

Delaware County Council of Chester, Pa., held an open meeting on Saturday evening, November 1, which was largely attended by local engineers as well as a number of visitors from Philadelphia and Wilmington.

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Camden Council held a successful prize drawing and incidentally spent a pleasant evening at their rooms, at Second and Arch streets, Camden, N. J., on Thursday evening, October 30.

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Brother Samuel B. Best of Camden Council met with a sad bereavement in the death of his wife, early in November.

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Brother A. D. Hamilton, of Pittsburg, the popular representative of the Mohawk Refining Company, of Cleveland, O., has just returned home from a six weeks trip through West Virginia, Ohio, and Indiana. He says he was unusually successful and met many old friends all along the route.

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Kensington Council No. 3, of Philadelphia, is showing unusual activity again and the outlook is good for some interesting meetings.

Southwark Council No. 4, of Philadelphia, will give a banquet and entertainment on a large scale, at Odd Fellows Temple on Wednesday evening, December 3.

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PITTSBURGH, May 11, 1903.

To the Officers and Members of the American Order of Steam Engineers:

Dear Sirs and Brothers:—I take pleasure in informing you that out of the many invitations that I have received from subordinate councils to convene the Supreme Council in May next in their several cities, I have decided to accept the invitation of Iron City Council No. 21. Consequently the Supreme Council of the American Order of Steam Engineers will meet in annual session in the city of Pittsburgh, Pa., on the eleventh day of May, 1903.

Details as to transportation and hotel accommodations will be furnished you as soon as arrangements have been completed.

I avail myself of this opportunity to thank Iron City Council for its courteous invitation, and also all other councils that have so kindly requested the Supreme Council to partake of their hospitality.

Fraternally yours,
CLIFFORD P. WILLIAMS,
Supreme Chief Engineer.

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Lehigh Council

Lehigh Council No. 15, of Allentown, Pa., held an interesting meeting on Wednesday evening, November 5th. Grand Chief Trout was present and made an interesting address, speaking of the thriving condition of the order throughout the state and complimenting Lehigh Council on their excellent work. This council now has one hundred and one members, and though but three years old, they have $1,250 in their treasury. Mr. L. L. Rice of The Practical Engineer, who was the original organizer of Lehigh Council, was also present at the meeting referred to and was cordially greeted. Mr. Rice spoke at considerable length concerning the vital need of a state license law for engineers and urging the Council to conduct a vigorous campaign for the passage of such a law at the coming session of the state legislature.

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Educational Committee, A. O. S. E.

JOHN MARTIN, Secretary, 2655 East Clearfield St., Phila.

The following questions are intended to create discussion in councils of the American Order of Steam Engineers. Answers will not be required by the Committee but prizes will be awarded by the Committee for the best essays prepared by individual members upon any of the questions asked. The PRACTICAL ENGINEER will give cash prizes for the best essays prepared by engineers whether members of the A. O. S. E. or not.

Given a proposition to select the machinery for a power plant for an office building, in which ample space has been allowed for the installation of the same. What type of the following would you choose and Why?

1. Boilers to be used to generate steam?
2. Furnaces, mechanical or hand firing?
3. Boiler feed apparatus, steam or electric driven?
4. Feed water heater?

5. Engines to furnish power for electric generators?
6. Electric generators?
7. Elevator machinery, hydraulic or electric?
8. Heating system?
9. Refrigerating machine to cool drinking water?
10. What provision would you make to ventilate the various rooms connected with the plant?

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Work for You

To the Individual Member of the American Order of Steam Engineers:

Dear Sir and Brother:—

One of the foremost purposes of our Order is to promote the enactment and enforcement of laws regulating the employment of those persons who shall assume charge of, or in any way operate, steam engines and boilers. Further, it is our duty to assist, to our uttermost, in placing this matter before our legislative bodies in a manner which shall leave no doubt in their mind that it is to the very best interests of the manufacturer, the engineer, and the general public, to eliminate the incompetent from a position where loss of life and property too often results from their employment.

The numerous reasons which can be advanced to support us in making such a stand are too well known to you all to warrant a repetition here, but I will take this opportunity to make a few suggestions which experience has taught me will be useful in framing and presenting such legislation. Hence, I would advise that we procure the very best legal talent to formulate a bill which will withstand the action of the courts should its constitutionality to be called in question—a very likely occurrence. A very necessary adjunct of such a law is the proper selection of inspectors and examiners. It is of the utmost importance that the act should contain such provision as to insure the selection of such men for the position as will be educationally and professionally qualified in every way to fill their position in a proper manner. Without such provision any legislation becomes of little value.

Furthermore, it is inadvisable to allow the examiner too much discretion—it frequently occurs where such is the case, that so much favoritism is shown as to make the law not only unfair, but also give rise to much discontent where otherwise we may have general satisfaction. In this connection it would be well to specify along with other things, a time limit of experience that an applicant shall have had before he may be eligible to the position of examiner.

It would probably be equitable to insert a clause which would permit the employment of unlicensed men for a short period where it is impossible to obtain men with the proper qualifications, but only with the full knowledge of the examiner and his consent that the man shall act. The period of time allowed for securing men with proper qualifications should, however, not exceed thirty days under any circumstances.

Above all else, avoid the issuance of special licenses—such as are issued in Massachusetts. A provision for special licenses affords not only a loop-hole, but a driveway for nullifying any license law which may be passed.

Another very important feature of a license bill of this type should be a provision for an appropriation of money to properly conduct the offices of examiners and secure enforcement of the law. The examiner should not have to be dependent upon fees for all or a portion of his salary. All fees should be turned into the State Treasury.

In closing I would advise co-operation with all engineers' organizations similar to ours in this matter where it is possible to do so without sacrifice of our principles. The ultimate results will be more thoroughly assured in our favor if our profession appears in the matter as a unit rather than as individuals.

Fraternally yours,

CLIFFORD P. WILLIAMS.
Supreme Chief, A. O. S. E.

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The Manufacture of Incandescent Lamps

Details of the Process, Long Regarded as a Trade Secret.

The manufacture of an incandescent electric lamp is of special interest because many of the operations have heretofore been regarded as trade secrets and carefully kept from the public.

The delicate filaments which produce the light are formed by squirting a paste made from cellulose (wood pulp) through dies, from which it emerges in the form of fine threads, which when dried are tough and flexible. These threads before they are dry are formed into the desired shape.

They are then packed in carbon dust and subjected to intense heat for many hours. The cellulose is completely charred, and the filament now practically consists of charcoal. It is then suspended in an atmosphere of hydrocarbon vapor, in a vessel in which a partial vacuum has been made, and a current of electricity sufficient to bring it to incandescence is sent through it. This decomposes the hydrocarbon, and a carbon soot somewhat resembling graphite is deposited on the filament. This is technically known as "flashing." After this treatment the filament has a metallic lustre resembling polished steel.

The glass bulbs are blown in moulds to secure absolute uniformity, and as they come from the glass-house they are perfectly smooth at the rounded end, and have a long open neck. To the rounded end is fused a short length of glass tubing opening into the interior of the bulb. This is subsequently used for connecting the bulb to the exhaust pump.

For making the connection through the glass between the carbon filament and the wire the most satisfactory material is platinum, because it adheres firmly to fused glass and because it expands and contracts at the same rates. If this were not the case, when it got hot through the passage of the current it would either expand more or less than the surrounding glass, and either break it or make a space through which air would leak. So through the little glass stopper which will eventually project down into the neck of the bulb are fused two platinum wires. This stopper, which has a flange at one end, is now called the mount or stem.

Next the filament is fastened to the ends of the platinum which projects from the stem. This is accomplished by means of a special cement which will stand a red heat. Over this paste is deposited a layer of carbon. The paste is then dried in an oven, and the stem, with its attached filament, is fastened onto the bulb by fusing the flange on its upper end about the neck of the bulb.

After this joint is carefully tested to be sure there are no leaks, the exhaustion of the air is accomplished by means of a mechanical air-pump, the last traces of gas or air being removed from the bulb by chemical means. When the vacuum is sufficiently high the tube through which the air has been exhausted is sealed off by means of a small lamp, leaving the small round tip seen on the spherical end of the finished globe.

The lamp is now practically completed and is sent to the testing department. Here it is subjected to a series of severe tests before it is considered ready for the market. If it passes these successfully, the base (the portion by means of which it is screwed into a bracket) is cemented on, and the completed lamp goes to the shipping department.

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The Combustion of Coal

By A. Edward Rhodes, author of "Mechanical Drawing for Self-Instruction."

The consumption of coal entails two processes; first, the conversion of carbon to the condition of gas or vapor, and second, the union of the carbon with the oxygen or air. It is this second step that is the cause of the intense heat with which we are familiar, and the product of this union is called carbonic acid.

The first step is not productive of heat, but on the contrary, it actually absorbs heat. In soft coal combustion, where there is a large amount of hydrogen compounds, the hydrogen gas is distilled off (absorbed as above) from the coal in the first step, and its oxidation produces water, which goes off with the carbonic acid in the form of steam. It is obvious, then, that from perfect combustion the gases which pass off should be invisible carbonic acid and invisible steam. If there is sulphur in the coal in perfect combustion it will disappear as invisible sulphuric acid gas, and the solid mineral matters of the coal should remain behind in the form of ash.

It is well known that carbonic acid is not a supporter of combustion, and the ordinary domestic fire extinguisher is constructed upon this principle. To maintain a perfect combustion it is necessary that the proportion of carbonic acid present in the air over and about a fire shall be kept so low that the carbonic acid, when formed, shall be less in quantity in that atmosphere that is to support combustion. Therefore, the flame which makes a perfect combustion is one in which there is an excess of oxygen with its attendant insert oxygen. It is bluish, or violet, in color, and is by no means the hottest kind of flame.

The yellow or white flame, which we see in the combustion of illuminating gas and soft coal, is a mixture of the hydrogen flame making steam as its product of combustion, the carbon flame making carbonic acid as its product of combustion, and the carbon rendered incandescent by their combustion. If this incandescent carbon can meet oxygen at a temperature high enough to unite with it, such union will take place, and we get a smokeless combustion. If for any reason the carbon should not meet the oxygen needed after leaving the place where its temperature is high enough to attain incandescence, it will, on cooling, appear in finely divided black particles, which, darkening the invisible gases of perfect combustion, will be called smoke.

The white flame is a feature of relatively imperfect combustion, and is the best flame for boiler purposes. As we ordinarily see it, it indicates that there is not quite enough oxygen to produce the complete combustion of the bluish or violet flame. In the boiler furnace, due to its possession of incandescent matter in suspension in the current of gas, it acts to make steam by the transfer to the water of the radiant heat from the large radiating area where is the flame. It is for this reason, more than any other, that the softer varieties of coal are preferred for steam boiler purposes, apart, of course, from any difference of cost. As the readers of the Practical Engineer are more especially interested in the steam-making side of this burning question, it may be worth while to call attention to the fact that the heat from the fire gets into the water in the boiler by radiation (just as it gets out of the cylinder of your engine by radiation) from the incandescent carbon, and also by contact of the iron and hot gases.

Of these two methods for the transfer of heat, radiation is a great deal more efficient than is the transfer by contact, depending in either case upon the difference of temperature between the transmitter and absorber of heat. This difference enters into the formula for radiation as a coefficient, and into the formula for transfer by contact as an exponent; and a moment's thought will convince anyone that, with a given difference in temperature between the boiler and the source of heat, the transfer will be much more efficient by radiation. For this reason, in designing boiler settings for coke or anthracite coal, where there will be but a short flame, and where the minimum supply of oxygen will be required, we must depend for our heat mainly upon the radiation from the fire-box or furnace area, while with bituminous or gaseous coal, that radiating area will be limited, not by the length of the fire-box, but by the length of the flame carrying white-hot particles with it. It is for this reason that there is any justification for the use of water in the ash-pit or for the use of water in the fuel, the hydrogen from that disassociated water giving to a short flame a superior radiating capacity. But in firing a boiler it must not be forgotten that we are compelled in the furnace area to effect both the distillation of the carbon and the hydrogen gases, and their combustion.

When fresh bituminous or flaming coal is thrown upon a boiler fire, the first process is the distillation of these carbon and hydrogen products. There will appear a brownish or yellowish gas which looks like smoke, and which will eddy and billow out of the smoke-stack after fresh firing. This brownish or yellowish gas is not a real smoke, although it is called such by, I might say, everybody, and it is what is objected to by those who speak

of the smoke nuisance. The color is mainly the result of the presence of tarry matter, as can be proven by holding in the gas some condensing surface, as a plate, etc. The material gathered is sticky, but does not contain what is called sooty matter. Collect enough of it and make it hot enough, it can be ignited, and will burn with a white and real smoke flame. During the period of this distillation there is comparatively little steam made, the heat of the fire being masked by fresh coal over its radiating surface, and being somewhat consumed for the formation of this distilled product. This same process will happen with any compound rich in hydrogen, as wood-shavings, sawdust, etc. It is to avoid this miscalled smoke that we resort to the coking method of firing. If we could distill this material from the solid fuel under conditions that it can be retained, to be burned at a high temperature as gas, we would do away with the loss and the discoloration of the atmosphere during this stage of the combustion process. During this period, whether or not there is smoke to be seen issuing from the stack will depend upon whether there are present the two conditions necessary for the satisfactory combustion of an illuminating flame of this type. The key to the smoke situation, it seems to me, would be in securing for the incandescent carbon a sufficient supply of oxygen at a high temperature, to secure its perfect combustion, after it has done its work by radiation to the heating surfaces of a boiler. The general conditions for preventing smoke are these: Efficiency of plant and fireman to attain the development of such a high temperature, and oxidizing action as to insure the combustion of the free or separated carbon which forms the visible smoke; to secure regularity of action under the widely varying conditions induced by fresh charges of coal, the cleaning of fires, etc., bad water or coal. The only other condition, and it is contained in the first, is that of capacity, so that the boiler will be efficient, not only at its rated capacity, but even when forced.

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The steam gauge and safety valve should correspond when the safety blows. If they do not, one or the other is wrong and both should be tested by a standard known to be correct. Water gauges should be kept clean and open, and the passages should be blown out often. Many accidents have occurred by being mistaken about the height of the water in the boiler, and a reliable high or low water alarm is a valuable auxiliary. In case of low water, immediately cover the fire with fresh coal, ashes, or anything that will deaden. Draw fire if it can be done without increasing the steam pressure, and do not turn on feed, or stop or start engine, or lift safety valve until the boiler has cooled down and the fault is remedied. Use only the best cylinder oils for lubricators for the engine, pumps, steam cylinders and adjuncts to maintain all parts in good condition, and keep everything clean. Repair weak places as soon as possible after noting same, and maintain careful and systematic inspection.

LETTERS FROM ENGINEERS

In order to make this department of THE PRACTICAL ENGINEER as interesting as possible, a moderate rate will be paid by us for all contributions published under this heading. However, we do not assume responsibility for the ideas or opinions expressed. None need hesitate to contribute because of inability to draw or write well. We will redraw or revise whenever necessary—it is the idea we want. New ways of doing old things, criticisms of accepted theories and general engine room experiences are especially solicited.

Worth More than it Costs

Editor The Practical Engineer:

Dear Sir:—Accept my apology for having to be informed that my subscription to your most valuable journal has expired. Honestly I would not miss one copy for the fifty cents, for I sincerely believe it is worth twenty times its cost to any one in charge of a steam plant. Why, that one article in your last issue, "The How and Why of the Corliss Engine," was worth many times the cost of the journal for a year. Enclosed herewith please find fifty cents for renewal of my subscription.

I would like to become a member of the A. O. S. E., and I would also like to have a license. I am prepared to stand an examination, but am 60 miles from a railroad and as I am getting $5 a day I cannot now afford to lose the time.

Now I am going to try to add something to your columns that may interest some of your readers, in regard to adjusting an eccentric on a slide-valve engine when it has slipped. Put crank on either dead centre, remove steam-chest cover, turn eccentric on shaft and move reverse lever alternately until the valve has no travel at all by reversing engine, then the eccentric is right; now proceed to set valve if necessary. Of course if the eccentric rod bolts and the block in link is worn so there is lost motion, the valve is bound to travel a little, though this is a most simple way and quite accurate.

Lundy, Calif. B. D. S.

When an Engineer is not an Engineer

Does it pay to have the engineer leave his engine-room—sometimes for hours—to do odd jobs around the plant? We all know that there are many manufacturers short-sighted enough not to perceive the risk they assume in having an engineer who is expected to run his engine merely as a side issue, while he is keeping the whole factory in repair.

Some years ago while journeying through the West, I stopped in a small town for a short time, and while there I determined to spend a day looking over the engines and engineers of the place. So, starting out in the morning, I walked into the first engine-room I came across. The engineer saw me enter, but said nothing.

After standing around for a few minutes, I picked up courage enough to walk over to him and asked if there was any objection to my looking over his engine-room. He said, "Just wait until I fill the oil cups and I'll show you around." This I appreciated very much, and after the duty of filling the oil cups was performed, I accompanied him to the boiler-room.

After showing me the boiler, I was much interested in his description of an automatic shavings feed used for firing. He said, "This feeder is certainly a blessing. Before getting this I used to have to shovel the shavings by hand, and I didn't have very much time to waste on anything else. Now the shavings are fed automatically. First, we have a large fan which draws the shavings from each machine and discharges them into a large collector, about thirty feet above the floor. The centrifugal force of the shavings separates them from the dust, the dust passing out into the atmosphere. The shavings are fed to the boiler's furnace through two pipes leading from the collector. The arrangement is very good, it requiring very little attention.

"I need a new pump, too, but it is pretty hard to get anything new here." The pump he had was a Worthington Duplex, and was running at top speed in order to supply the boiler with water.

From here we returned to the engine-room. The engine I found at a glance to be very much overloaded. I noticed a rubber hose running from a nearby water main to the main bearing and also a branch hose attached to the crank-pin bearing. I asked the engineer his reason for running the water over the bearings. He said he couldn't run fifteen minutes without it or the bearings would get red-hot. Just at this time the superintendent came in and rather harshly requested the engineer to go up-stairs at once and fix a glue stove. While he was picking up some tools preparatory to going upstairs to do the work, I bade him good-bye, and wended my way toward a factory some two hundred yards further on, but, before reaching this place, I was halted by hearing an unusual noise at the place I had just left, and, turning, I saw a number of men jumping from the windows of the place. I stopped, of course, for a few minutes to see what the trouble was about and after inquiry I was told that the engine had run away. Thinking I could be no use there, I then went to the other place and told the engineer that something was wrong across the way from him, and he said, "You bet there is, and has been for a good while." The following day I met engineer of plant No. 1, and asked him what was the trouble. He said that five minutes after I had left on the day before, and while he was repairing the glue stove, three floors above, something cut loose in the engine-room and by the time he got down there the engine had pulled the machinery all over the floor out of place, the elevator was smashed, and several belts were torn to pieces. And all this on account of a boy and a stick: Each man running a machine, planer or saw, has a helper boy. Among other duties of the boy is that of carrying the rubbish from the saws to the boiler-room. One of these boys while passing through the engine-room with a bundle of sticks, and seeing no one around, stopped to see the wheels go around. The governor seemed to attract his attention the most, and he began to try to stop it with one of the sticks he had, and then the fun began, and the boy saw quite a number of wheels going around for the next few minutes. The boy was too frightened to run, and it only required a glance to see what caused the trouble. The engineer told me that this case was only an instance of like occurrences, as all kinds of things happen when he is out of the engine-room, which was pretty often, as he was required to do all the piping around the mill, file all circular saws, brace the band saws when they broke, temper the planer knives, and in fact anything that needed to be fixed. Does it pay?

Allentown, Pa. J. T. L.

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Old Men or Young Men

Editor Practical Engineer.—From time to time I have noticed in different periodicals, instances, both pro and con, relative to the value of old men in our shops and engine-rooms, and I am sorry to say that in the majority of cases I find that the old man is considered by the writers as a drug upon the market, and not wanted. Now, while I am not an old man, I feel like saying a few words, through your valuable columns, which will, I think, delineate the real value of the old men, and also show wherein he is of value to any employer.

I have for a number of years had occasion to employ men at skilled labor, and have had employed during that time both old and young men, and men who gained their knowledge through years of the hard knocks of experience, also men—graduates of the technical schools—who come under the class known as young men.

Actual experience has taught me that while in many instances the younger, and probably better-educated, man will do well as long as things run smoothly, the old man will be the one to be relied upon in emergency cases; they seem to realize so much quicker than the younger man what to do and how to do it.

I will relate an instance or two corroborative of my statements, which came under my observation. A short time ago I happened to be in a mill in Philadelphia, which was in charge of a graduate of one of our leading engineering schools, and was probably a good man. However, while I was there a crack was discovered in the engine cylinder (a large engine, too) reaching through the flange to within about six or seven inches of the back end. The young engineer in charge gave as his opinion that the plant would have to shut down until a new cylinder could be secured. This edict, of course, caused great consternation to the mill-owners, to whom the enforced shut-down meant a great loss. But, as there seemed nothing else to do, they made preparations to shut down. At this time the assistant engineer, who was a man about 70 years of age, stated that he could repair the damaged cylinder during the following evening, and with little or no expense, thus preventing the shutdown at all.

His plan was so simple and inexpensive that he was given a chance. He at once went to a nearby blacksmith shop and had a band made to encircle the flange; this

was placed over the cylinder flange, the crack was well dosed with sal-ammoniac, and then it was closed by means of a draw bolt through the band. This repair was so effective that no further attention to the defect has since been found necessary.

I am pleased to say that the real value of this old man was at once recognized, and he was placed in charge of the plant shortly after, and has given satisfaction.

In another place, at another time, I happened to be in an engine-room and heard a consultation between the chief engineer (a young man) and some of the officials of the place, over a bursted cylinder head. The decision of the chief engineer was that the plant shut down until a new head be made—about a week. This the officials were forced to acquiesce in, much against their will. At this juncture an old man—also employed as an assistant engineer—stated that he could make a temporary repair which would outlast the time required to make the new head. He was asked how? And he said he would make a wooden head; this he was permitted to do, and it worked successfully. I think I am safe in saying that we cannot do without our old men any more than we can do without our young men.

Yours occasionally.

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"Grease Versus Oil"

Editor, "The Practical Engineer."

Dear Sir:—I would like such of the readers who keep The Practical Engineer upon file to turn to my letter on page 19 of the October issue, which Mr. Hopper (of the Keystone Lubricating Co.) criticises, as well as to Mr. Hopper's letter on page 18 of the November issue.

I make this request, because I, also, want nothing but facts, and because Mr. Hopper misquotes me, and it is evident that he misquotes me to suit his own argument.

The facts are in cold print.

Mr. Hopper says that in one part of my article I make the statement, "that grease is a refrigerant and that it does not reduce friction."

That this is a positively false quotation can be shown by reference to my article in the second paragraph on page 19 of October issue. On the 7th line I say, "for grease does not reduce the friction to the lowest minimum." In the same paragraph on the 20th line I say, "But remember grease does not increase frictional resistance; it reduces it, but not as much as the proper oil," and in no part of any article or advertisement that I ever wrote upon the subject of grease did I deny that grease reduced friction.

Now, Mr. Hopper writes, "I am not upon record as an expert upon the subject of lubrication."

I do not think that I have ever claimed to be an expert. Anything that either Mr. Hopper or myself might claim or disclaim for either of ourselves would not make or unmake us experts.

We are experts only from the position of expert knowledge and experience upon a subject, and, as the courts have decided that I have such knowledge and experience, I am qualified in stating that I am on record as an expert.

Those versed on the subject of lubrication, after reading Mr. Hopper's article, must conclude that his disclaiming to be an expert on the subject of lubrication is superfluous.

Now, Mr. Hopper again quotes me, and this time with the quotation marks as follows:

"What matters it to me whether I am using a quarter horse-power or more by using grease so that I am sure of getting home under my own power."

Mr. Hopper then further writes: "Now I feel sure if Mr. C. E. C. would have thought a moment he would not have made such a statement. For instance, he must know that where there is friction there is heat—that is one of the unalterable features of nature."

I certainly know that there is not only heat where there is friction, but there is heat every other place where a human being lives, and I cannot for the life of me see what the heat has to do with it.

Mr. Hopper goes on to state, "There is just two ways to reduce such heat, one is to apply locally some means of removing the heat units as fast as created, in other words apply a refrigerant; the other is reduce or remove the frictional cause of the heat. It must be remembered that the refrigerant does not reduce the friction, it simply reduces temperature."

Mr. Hopper could not have studied the rudimentary principles of oleaginous matter and have made such a statement. The idea of an oleaginous substance not being able to possess both refrigerating and lubricating properties! Any doctor of medicine, any student in chemistry, any pharmacist can tell you that if the skin of the human body is badly burned the first thing they do is to apply an oleaginous salve, which must possess two properties, one of lubricating the flesh and skin as it forms, and the other to refrigerate and keep down the temperature; and there are hundreds of articles in use for lubricating machinery, and every single article that is used for lubricating machinery, oils included, possesses both refrigerating and lubricating properties.

I did not have to think for a moment before making such a statement, and no one versed upon the subject of lubrication would have to think. They would know it almost intuitively from their natural knowledge of the subject caused by their experience.

Of course, some oils as well as greases are the opposite of refrigerants, and they are irritants. Take mustard seed oil, for instance.

Mr. Hopper would have you believe that the one great object of a lubricant is to reduce heat, and that is what every grease man believes, if he believes the theory he preaches; but this is not the object of true economical lubrication. The object is to decrease friction.

Now, Mr. Hopper states, "It is quite possible that Mr. Carpenter has found grease to be an article seldom to be depended upon as a friction remover; the only real objection I find in his articles is that he includes all grease in his category and not—as he should—the kind of grease he is accustomed to using alone."

I might say for Mr. Hopper's information that I have used several hundred pounds of Keystone Grease in my

experiments.

Will Mr. Hopper kindly quote one authentic case where an expert upon the subject of lubrication has proven that greases were superior to oils as friction reducers? I do not mean some engineer who has had all he could do to verse himself upon the use of steam; I mean the man who has made the economics of lubrication his study.

Thurston, who is considered by some (but most certainly not by myself) the greatest authority who has written upon the subject, in his work entitled "Treatise on Friction and Lost Work," 3d edition, published by John Wiley & Sons of New York, gives us the relative friction reducing powers of greases of various kinds, as compared with sperm oil, and with sperm oil at 100 the very best shown for a grease was 44.8, and that was for the softest grease, which, of course, contained the most oil.

The best article on lubrication that I ever heard was read by Wm. F. Parrish, Jr., of Boston, Mass., before a meeting of the New England Cotton Manufacturers Association in New York. (The New England Cotton Manufacturers Association will, I believe, mail copies of that article, and I intend to republish it.)

This article treats of high pressure oil, low pressure oil, engine oil, dynamo or motor oil, general lubrication for heavy machinery, general lubrication for light machinery, shafting oil, etc.

In this article Mr. Parrish ignores the use of grease as a general lubricant, for he writes generally, very properly thinking that he was reading his article to an intelligent audience, and that no one ever would dream of adopting grease as a general lubricant.

The only mention he makes of grease is the following under the head of shafting: "Any admixture of filtered oils from engines or machines, or any use of grease will increase the power necessary to drive that shafting."

Now, Mr. Hopper has intimated that the oil man sells grease merely because there is a demand for it. I suppose Mr. Hopper sells grease because there is not a demand for it.

Yours very respectfully,
CHARLES E. CARPENTER.
General Manager,
E. F. Houghton & Co.

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A remarkable system of smoke prevention was described at the recent meeting of the British Association at Belfast, which, were its efficacy not attested by so well-known and experienced an engineer as Mr. J. S. Raworth, might not unreasonably be looked upon with incredulity. The essence of the system consists in injecting a mixture of air and nitrate of soda solution on the top of the fire. The Wilson process, as it is called, has been thoroughly tested by a competent engineer, and in addition has been successfully applied to a number of smoky furnaces; besides eliminating smoke, the process effects a marked increase in evaporative efficiency, over 20 per cent improvement having been recorded. The simplicity of the process is one of the strongest points in its favor, the cost of putting it to the trial being insignificant.

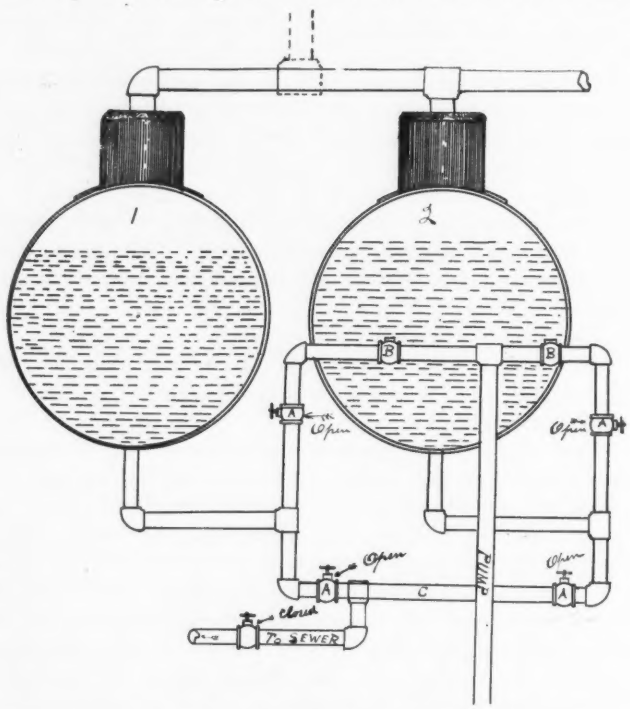
QUESTIONS AND ANSWERS.

THE editor will be glad to receive from the readers of THE PRACTICAL ENGINEER, such questions relating to engineering subjects, as may, from time to time, occur to them. All questions and answers should be addressed to the editor and accompanied by the name and address of the writer, which will not be published, however, unless especially desired. It is the intention that questions shall be answered by the readers, and even though the editor may, from time to time, publish answers with questions, he especially desires the readers in such cases to contribute any further information in connection with the points raised, that they may consider of interest. All questions and answers received by the editor will be published, as far as practicable, but he reserves the right of editing or rejecting any communications.

Editor Practical Engineer:—Please state in your columns why I cannot keep the water equal in height in my two boilers, when the feed pipes are arranged in the manner shown in the accompanying drawing. The boilers are attached to one steam main, hence the pressure is always equal. Now, when I start the pump and open cocks, as shown in illustration, I find that boiler No. 2 always gets more water than No. 1. The pipes are all as free from dirt as they can be—blowing freely at any time.

J. S. Taylor.

In your system of piping there is some difference in the number of feet of travel of the water from the pump to the different boilers, consequently there is more friction in the pipe to No. 1 boiler than there is to No. 2. The bulk of the water will, of course, follow the line of least resistance and find its way into boiler No. 2. However, the difference in this case is so small, that there should be very little change noticeable from the above cause.



The real trouble lies in the method of your steam connection. Instead of your piping running from No. 1 boiler to No. 2 and thence to the engine, it should be connected in the manner as indicated by the dotted lines. Under the present conditions you are using more steam from boiler No. 2, thus lessening the pressure. The

decrease may be less than one pound, but that is enough to cause the condition now existing in your water supply. A remedy may be had by throttling valve No. 2 until they feed alike.—Editor.

Editor Practical Engineer :—Will you please let me know through your columns, whether an overloaded dynamo can be benefited any by reducing the voltage of the incandescent lamps in the circuit? For instance, instead of 110 volt lamps, use 104 volt lamps. If so, has the voltage to be reduced accordingly at the switchboard? What change is required for running on direct current a small fan motor built for alternating current?

Nazareth, Pa. J. A. J.

The only way you could possibly benefit by reducing your voltage on the lamps would be in case you wish to get a greater distribution of your light without increasing your load; in other words, by using 104 volt lamps of 10 or 12 C.P. instead of 16 C.P. If, however, you wish to use a 16 C.P. lamp at 104 volts, instead of being benefited you will lose by the change. To generate 16 C. P. at 104 volts will require more amperes than the 110 volt lamps to produce the same light. The only means of increasing your light under present circumstances, would be that of increasing the speed of your engine with a corresponding increase in the voltage. This would necessitate considerable change in your plant and it is doubtful if it would pay. Unless one is very conversant with the details of such work there is no end to the trouble he may get into making the change. First, there is the cost of new lamps throughout; then the work of speeding up the engine, and here we find a chance of overloading, which none but an expert should take, and even then the gain does not justify the expense. Referring to the fan motor, we would say that it is impossible to answer your question without knowing the style and make of motor.—Editor.

A Large Belt Requiring 360 Hides and Weighing 3,600 Pounds.

A very large leather belt was recently put in service in the power-house of the Twin City Rapid Transit Company, at Minneapolis. The total weight of the belt is 2,000 pounds; it is 100 feet long, 80 feet wide and of three-ply thickness, costing about $1,800. Eight hides were required for each four lineal feet of the belt, which means that 200 head of cattle were required to furnish enough leather for it. In its construction no fastenings of any description were utilized, with the exception of a special belt cement of high adhesive power. The services of 15 men were required for more than a month in its manufacture.

The firm which made the belt some time ago completed one for a copper-mine power-house in Anaconda, Mont., which was 180 feet long, 66 inches wide and four-ply. This belt required 360 hides and weighed 3,600 pounds. The speed at which it is operated is 5,000 feet per minute, transmitting an average load of 1,800 horse-power.

"Take-Up Device"

For use in connection with Detent on Indicator.

The great trouble experienced when using the detent on the Steam Engine Indicator is that of the slack given up by the cord between the paper drum and reducing bushing on wheel. This slack if not properly guided when throwing on detent is liable to get foul, thereby in many instances wrecking the instrument or at least breaking the cord—causing delay and inconvenience to the operator.

The Take-up Device is presented for the purpose of doing away with all this annoyance. It is simple in its construction and can be applied to any standard indicator.

It consists of a short horizontal arm, at one end of which is a vertical bearing, in which sets a steel pillar on the upper end of which there is a frame holding a double set of loose steel rollers; between these the cord

from paper drum passes. On the lower end of vertical pillar there is a light spiral spring enclosed. This spring causes upper frame to revolve when cord becomes slack, and is so arranged that cord winds on frame, to be given up again when tension is applied.

The object of the device is to permit the operator to take as many cards as desired without unhooking from the crosshead or stopping the engine, no matter what speed. This of course pertains to indicators that are fitted with a detent and using a direct connected reducing motion—the latter being by long odds the most popular in modern engineering practice.

Where an indicator is used in connection with pendulum, lazy tongs or reducing motion attached to engine frame, not so much trouble arises, and generally a rubber band employed to take care of slack cord, which works fairly well. In this case we have arranged the Take-up Device in the shape of a regular guide pulley to connect direct to indicator, the guide pulley is removed and this put in its place, wound up and it is ready for use. This can also be used with satisfaction as a guide pulley if

not needed to take up slack cord, as the little pulleys are arranged to let the cord run through with perfect freedom, and immediately the detent is engaged, it picks up instantly what slack cord takes place. The tension of the spring in this device being so much weaker than the drum spring, soon as detent is disengaged, the cord is instantly released and drawn out taut and assumes its regular position.

We do not confine the Take-up Device to these uses only. It is also attached to engine frames and used in various other ways.

It is strong, well made and compact, and makes a very attractive attachment. It is good for any number of revolutions and is designed to fit all standard indicators and reducing wheels, or it can be made as a special fixture. Information can be obtained from the manufacturers, James L. Robertson & Sons, Fulton St.

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A Modern Manufacturing Establishment

The Lunkenheimer Company, of Cincinnati, Ohio, manufacturers of brass and iron goods and specialties for engines, boilers, etc., such as brass and iron valves, whistles, injectors, lubricators, oil and grease cups, etc., on Saturday, October 25th, formally opened their new works to about three thousand visitors and friends and are now moving from their old quarters on Eighth Street.

The buildings, of which there are five, represent an investment of over three hundred thousand dollars, consisting of the main building occupied by the brass department with adjoining buildings for the iron department, brass foundry, power building and office building; all are of pressed brick and steel construction of modern type.

They occupy about three acres of ground and have switching facilities; three acres additional ground provide for future extension of the business.

These factories are located near Brighton Station in a section of the city called Fairmount, within two miles of the center of the city. It has been the aim of the Company to construct a "model" plant and many new and interesting features are noticeable.

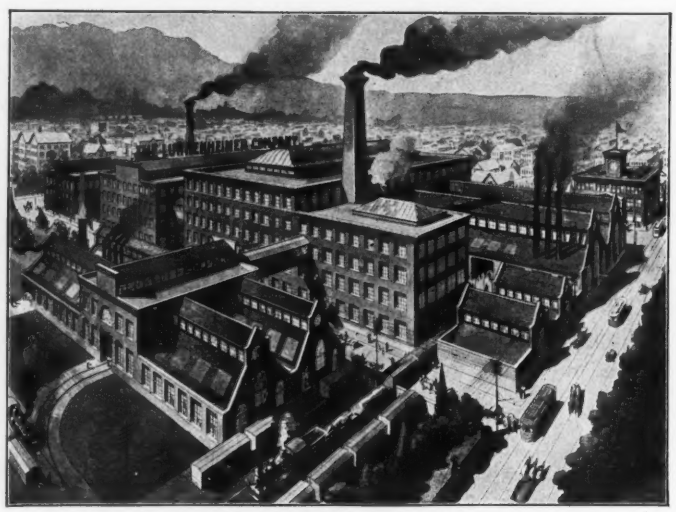
The main building, 130x180 ft., is of gallery style construction with a center area 30x80 ft.; is three stories high and built so that three more stories can be added without interfering with business.

The elevators and iron staircases are arranged within the center area. All buildings are designed for 300 lbs. per square foot floor load. The roofs are glass and clay tiling of Ludowici interlocking type.

A novel feature in the main building is the heating system, inasmuch as the hot air travels through the fourteen large hollow columns which support the floors around the area in the center of the building. These columns have openings on each floor to distribute the air; the bases of the columns are connected with a huge fan by means of tunnels under the basement floor. By this construction the usual galvanized iron air pipes are done away with and it adds greatly to the simplicity of the building.

The type of window used is a novel one, and has a blind arrangement that is of great advantage during summer weather. The foundry is equipped with modern appliances such as overhead track system for carrying material, smelting furnaces burning crude oil, and many pneumatic appliances, such as are used in the latest foundry practice. The general distribution of power throughout the buildings is strictly modern. The source of energy is a 300 H. P. compound engine which drives a 240 K. W., three phase, 220 volt, General Electric, alternating current dynamo. The current is led out from a switch-board to the different parts of the buildings where suitable motors (principally attached to the ceiling) are provided to drive the various lines of shafting. These motors are of the Westinghouse and General Electric induction type without commutators or brushes. The power from the motors to the shafts is transmitted through what is known as the Renold Silent Chain Gear, which permits of a very compact arrangement without noise and friction, thus dispensing with leather belts.

The engine room is also provided with a large cross compound two-stage air compressor, which supplies compressed air throughout shops and foundry for driving pneumatic tools, hoists, etc. The boilers are of the water-tube pattern with automatic stokers. The engine room, the floor of which is laid in mosaic tiling, is considered one of the handsomest in the country; the Company manufacturing engine and boiler fittings aimed to have a power plant strictly up-to-date and of handsome appearance.



SHOPS OF THE LUNKENHEIMER CO.

Telephones connect all departments to a central exchange which connects with the city lines, thus affording immediate communication from any point in the works.

The illumination is furnished by what is known as the Nernst Lamp, made by the Nernst Lamp Company, of Pittsburgh. This lamp has been going through a process of development for a number of years and is now past the experimental stage and is being adopted throughout this and many foreign countries. The quality of light differs from that produced by any other artificial means, inasmuch as it more closely resembles sunlight than gas, incandescent or arc light, and articles exhibited under it have their true color value. Owing to

the arrangement of the lamps, the distribution of the light is absolutely even and without shadows. The lamps are so arranged that sufficient illumination is secured without providing each operator with an individual light.

The office building is a three-story press-brick structure 50x80 feet, with modern equipment, the second floor being occupied by the draughting and engineering departments, the third by advertising department, as well as a laboratory and photograph gallery.

The business was founded in 1862 by the late Frederick Lunkenheimer and has grown to large proportions, now employing over 700 men. With increased facilities the Company expect to extend their line and take up many new engineering specialties.

The Company's trade is domestic and foreign, being distributed largely through jobbers; they also have a branch store in London, England, and an office in New York City.

The Company have placed many orders for additional tools and machinery, which are being installed in their new quarters.

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A Boiler Explosion at the Armour Plant, Chicago 15 Lives Lost

Through the explosion of a boiler on November 29th the plants of the Armour Packing Company, Chicago, 15 persons lost their lives and doubly as many were injured more or less. As far as we could learn before going to press the cause of the explosicn was low water—this is, however, largely problimatical, the water tender, who would know to a certainty, having lost his life.

The terrific force excited by escaping steam created wreck and ruin on all sides—the property loss alone, it is said, will be over $50,000.

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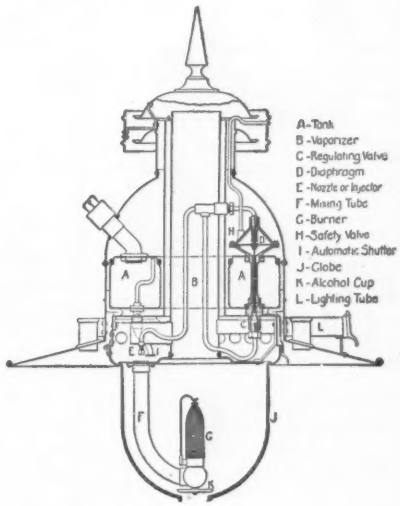
Incandescent Light From Liquid Fuel

The evolution of incandescent lighting through the medium of liquid fuel has long been a subject of research by inventors, and while there are several devices now upon the market, probably there is none so efficient or economical as that shown in the accompanying illustrations. This lighting system is manufactured by the Automatic Incandescent Light Company, Philadelphia, Pa.

The lamp consists of a circular tank placed in the dome, a vaporizing coil connected at one end to the bottom of the tank, and at the other end to the nozzle through which the gas is injected into the mixing tube at great speed. The vaporizing coil extends above the tank and has a third connection with the top of the tank through which the gas generated in excess of the amount required to operate the burner is forced into the tank. This accumulation of gas produces the pressure which dispenses with the air pump necessary for the operation of a pneumatic lamp. The pressure thus generated gradually increases until the desired point is reached. Then its upward pressure against a diaphragm arranged on top of the tank closes a valve, which up to this time has been held open by a spring, which shuts off the supply of gasoline to the vaporizer, when as a matter of course the production of gas ceases.

Then the burner is fed from the stock of gas previously stored in the tank, passing out through the pipe which conducted it there, into the vaporizing tube, and thence to the burner. The withdrawal of this gas from the tank soon results in decreasing the pressure, so that the spring actuating the supply valve will open the same again, renewing the supply of gasoline to the vaporizer, and renewing the production of gas.

The construction of this lamp is so simple that the makers claim it requires less care than a kerosene oil house-lamp. The loop in the vaporizing tube extending above the tank renders it impossible for liquid gasoline to reach the nozzle or injector, and therefore the lamp cannot overflow, nor can any sediment or impurity that might be in the gasoline lodge in the gas orifice, as nothing but vapor reaches that point. The



candle power is regulated by a screw in connection with a spring actuating the supply valve, the position of this screw determining the pressure at which the valve will open and close. This is not a needle valve, and cannot clog.

To put the lamp in operation it is only necessary to apply heat to the lower part of the vaporizing coil, in which there is always a supply of gasoline. The effect is to generate gas, which passes over the top of the loop down to and through the injector (which is always open) into the mixer, and thence to the burner, which when once lighted furnishes the heat required to continue the production of gas. This process continues until all the material in the tank is consumed, when the light goes out of its own accord, rendering it unnecessary for an attendant to extinguish it.

The capacity of the tank is five pints, quite enough to run fifteen hours. Put just enough gasoline in the tank to last a desired time, and the lamp will take care of itself. One gallon of gasoline will produce 300 candle-power twenty-four hours. Increased candle-power will, as a matter of course, require increased consumption.

TRADE NOTES

James McCrea and Company, 67 W. Washington St., Chicago, are sending out a catalogue which contains much of value concerning the ways and means of stopping leaky joints. This is a subject which interests all engineers alike. The losses from this source are comprehensively treated in a lucid manner as is also the Climax Steam Joint Clamp. A request for one will meet with a prompt response. Mention The PRACTICAL ENGINEER.

"The result of twenty years experience in boiler cleaning" will be sent, free of charge, to anyone interested in such matters. This offer is made by the Tagonda Manufacturing Co., Springfield, Ohio. This booklet should be procured by all engineers, as it pretty thoroughly delineates a subject that concerns the engineer, the fireman and the proprietor because clean boilers mean less work and worry on the one side, and less cost upon the other; hence it will pay to write to the above address and learn the remedy for the evil.

The strong claims made by the Keystone Lubricating Co., in their advertisement on another page, are backed with a sample can of Keystone grease and a brass grease cup which they will send to any engineer or steam-user, free of charge, and with expressage prepaid seems worth while to try it anyway.

Information about indicators, planimeters, reducing motions and most all steam specialties except engines and boilers may be found in the catalogue issued and mailed free by Jas. L. Robertson & Sons, 205 Fulton St., New York.

Pull the chain when the gauge glass breaks—no flooding the boiler-room floor, no burns—that's what Paul B. Huyette, 1245 Betz Bldg., Philadelphia, says about his new quick-closing water gauge.

"The Life Preserver" is the title of a small but handsomely illustrated booklet issued by the Wisconsin Graphite Company, Pittsburgh, Pa. The intent of this work is to show in a measure the vast possibilities of graphite as a protector for iron and steel when used as a paint. The affinity of graphite for metals of any kind is so much greater than that of any other pigment that it is said to be completely eclipsing all other paints for that purpose.

Another booklet issued by this Company contains much information that may initiate the engineer into the possibilities of graphite as a lubricant for steam cylinders—a thorough knowledge of which is valuable to the up-to-date engineer.

The Garvin Machine Co., Spring and Varick Streets, New York City, have recently issued a catalogue which will interest engineers. Many engine rooms at the present time include, as an adjunct to the plant, a machine shop of some kind. The catalogue above mentioned contains a very complete list of illustrations showing machine shop equipment of every description and size. In addition to new machines of the latest approved types, the Garvin Company maintain a second-hand department which is replete with a number of machines that have been used. Lists of both new and second hand material can be had for the asking.

To any one contemplating entering upon training for any particular profession the question, Will it pay? is of interest. To those anticipating the course of a Mining Engineer the Year Book of the Michigan College of Mines will be invaluable. It contains announcements of the course of study for the school year of 1902-1903 in addition to approximate knowledge relative to the possibilities of that profession. The book may be obtained by addressing the Michigan College of Mines, Houghton, Mich.

It will interest our readers to know that the Crane Company of Chicago have recently issued a new pocket catalogue. It is nicely bound in cloth, containing 464 pages of matter delineating the entire line of goods manufactured by this popular house, who include in their output standard, medium, low-pressure, extra heavy and hydraulic goods in iron or brass, engineers' supplies, tools, etc. This book may be obtained by writing the Home Office, Chicago, Ill.

"Electrical Novelties and Experimental Apparatus in Dynamos, Motors and Gas Engines," is the title of a very interesting and instructive hand book and catalogue issued by the Carlisle and Finch Company, 229-231 East Clifton St., Cincinnati, Ohio.

To the engineer anticipating the manufacture of experimental or model engines, dynamos, etc., the book will be of great value. It contains much information concerning the putting together of small work of this kind besides showing the material of this kind which may be procured ready for assembling. A postal request, mentioning The PRACTICAL ENGINEER, will procure a copy of this versatile little book, free of cost.

Overalls, like other commodities, are of various quality, as every mechanic knows, but not every one knows that most of them are made in sweat-shops, dirty hovels where filth and disease lurk in every corner. The editor of this journal recently visited the large factory of H. S. Peters, at Dover, N. J., where he found a most delightful contrast in large, light, airy rooms, well-dressed healthy looking employes and everything as clean and bright as a parlor. Mr. Peters manufacturers the celebrated "Brotherhood Overalls" and enjoys the distinction of being the only member of organized labor engaged in that business. He deserves the patronage of every American engineer and fireman. If your dealer does not keep Brotherhood Overalls, make him get them for you, or write direct to Mr. Peters.

Just Imagine

That you are the first man who ever bought and tested a

Cross Oil Filter

Forget that this Filter is sold in all parts of the world, and used by ten different governments.

Be skeptical—Order a Filter on 30 days' trial and make it convince you that it will "Save Half on Your Lubricating Oil Bills" and reclaim more waste oil and drippings than any other Filter your money can buy.

That's our way of selling Oil Filters—Burt Exhaust Heads, too.

THE BURT MFG. CO., Akron, Ohio, U. S. A.
Largest Manufacturers of Oil Filters in the World
Cross Oil Filters carried in stock by the
FAIRBANKS CO.
Sole Agents for Philadelphia

THE POSITIVE EXPANSION BOLT

Special Discount to Jobbers. Write for Prices

Manufactured by **D. C. SEAMAN & CO.**
1638 Hutchinson St., Philadelphia, Pa.
For sale by Neal & Brinke, 18 Warren St., New York; Somers, Fiths & Todd Co., 323 Water St., Pittsburgh, Pa.

IF ENGINEERS will send $1.00 to the address below they will receive two blue prints, with tables and instructions, showing how to set valves and eccentrics on Corliss engines, simple and compound, with one and two eccentrics. JOHN T. LINDSTROM, 440 Liberty Street, Allentown, Pa.

DO YOU KNOW

That we manufacture chemical water purifiers that are guaranteed to prevent and remove incrustation in steam boilers, no matter what its composition may be.

CHEMICAL PURIFIERS

that do this without injury to the boiler, its fittings or connections;

CHEMICAL PURIFIERS

that can be used with perfect safety in Breweries, Ice Plants, Dye Works and all places where the water of condensation is used for any purpose.

Write for terms, reports, circulars, etc. We interest you and pay liberal commission. Agents wanted everywhere.

THE PEERLESS SPECIALTY CO.
852 Swanson Street,
Philadelphia, Pa.

The most conspicuous part of a manufacturing plant or steamship being the smoke-stacks, it is important that they present a well-kept appearance. To preserve and beautify stacks, a paint must be used which will not be destroyed by the action of a high degree of heat in combination with exposure to extreme and varying atmospheric conditions. The height and heat of smoke-stacks render the painting difficult and dangerous. The expense and annoyance of frequent re-painting can be avoided by the use of a paint that will withstand the severe conditions for the longest time.

Dixon's Silica-Graphite Paint (Black) is specially prepared for stack protection, and has been continuously used for nearly 40 years by many of the largest steamship, smelting and manufacturing companies in different parts of the world. It is manufactured by Joseph Dixon Crucible Co., Jersey City, N. J.

At the Dusseldorf Exhibition, which has just terminated, the highest award of merit—the gold medal—was awarded the "Hunt" Conveyor. This Conveyor is manufactured by the C. W. Hunt Co., West New Brighton, New York.

The Burt Manufacturing Co., of Akron, Ohio, have just closed a contract for four large special style Cross Oil Filters to be used on four new battleships now being built for the Government.

Mr. S. S. Caskey, who for a number of years past has been the superintendent of mechanical instruction with the Harlan & Hollingsworth Co., has accepted a position with the F. F. Slocomb Co., of Wilmington, Del. Mr. Caskey is a recognized expert in pneumatic engineering, and is the inventor of a number of well known appliances in this line, among the number being the Caskey Portable Pneumatic Punch, and the Caskey Pneumatic Riveter, both of which are manufactured, with all latest improvements, by the Slocomb Company.

T. T. Burchfield Co., who looks after the sales of Gardener Steam Pumps and Air Compressors, American Standard and Berryman Exhaust Feed Water Heaters, Parker Exhaust Heads and Rumsey Triplex Pumps, have removed their offices to more convenient quarters at 610 Betz Bldg.

The Watertown Engine Co., builder of high grade, vertical and horizontal automatic engines, have moved their Philadelphia office to 610 Betz Bldg.

W. Clifford Smith, 45 North Second Street, Philadelphia, who is doing a prosperous business in grate bars, special castings, etc., desires to procure the agency for one or two good steam specialties.

The Grate Bar and special casting business, formerly conducted by Horace E. Frick, at 715 St. James St., Philadelphia, will be continued by Horace E. Frick, Jr. Young Mr. Frick was closely identified with his father for several years past and is in every way fitted to manage the business successfully.

FOR SALE

LARGE FACTORY IN NEW JERSEY.

Only an hour from New York. Property of over five acres of ground. with direct rail connection with Pennsylvania system, new three story brick building 60x260 with L 60x80, giving 57,000 square feet floor space. Three hundred horse power boilers and engines, building equipped with fire pump, water tower, tanks and sprinkler system. Plenty of cheap labor. Property can be bought at half value to close an intesest, and on easy terms.

NICHOLSON & CO.

Factory Brokers, Sole Agent,

150 Broadway, New York.

POSITION WANTED.

Young man 17 years, wants work in a machine shop, where he will have a chance to work his way up, not afraid to work. North or Middle, West preferred.

Address,

E. A. STARR, Pierce, Texas.

The predominating idea of the Green furnace is that the fresh coal at the beginning, just inside the furnace, releases the volatile gases, thus coking the coal; the gases passing over the fire-bed are consequently completely ignited. The coke is then pushed forward to finish its consumption by making the glowing fire over which the volatile gasses pass, this process being continued by the mechanism of the grate without opening or closing of fire-doors, etc.

The entire construction of these grates is interchangeable, each section being easily removable without interferring with the general construction.

In addition to a thorough description of the link grates, the booklet contains a set of tables giving the results of scientific tests of the value of coal from different locations, together with the total out-put from each section. A postal will insure, anyone interested, a copy of the catalogue. Mention this paper.

A JOINT

that does not and cannot leak is made by Dixon's Pipe Joint Compound. Easily upset without bending the pipe.

Ask for booklet 96.

JOSEPH DIXON CRUCIBLE COMPANY

JERSEY CITY

COCHRANE SEPARATORS.

It requires something more than a careful engineer to protect an engine from wreckage by water in the cylinders. Litttle by little, the water may collect in a pocket in the steam pipe until some day the steam brings it over in a rush, and away goes the cylinder. Nine times in ten it beats the engineer to the throttle.

Or maybe priming boilers send the water over into the pipe, and, before the engineer knows it, the result is the same—a wrecked engine.

A Cochrane Steam Separator is just the thing to give absolute protection against such an accident. Whether the water comes along the pipe drop by drop, or in a sudden rush, a "Cochrane" will stop it and pass only the steam.

Besides, a Cochrane Separator will give you the economies resulting from the use of dry steam and from better lubrication with less oil. These alone will pay the interest on the cost of the Separator, giving you absolutely free your insurance against "busted" cylinder heads, broken crank pins and bent pistons.

Send for Catalogue 16-S.

HARRISON SAFETY BOILER WORKS

3144 N. 17th St., PHILADELPHIA.

Manufacturers of Cochrane Heaters.

American Order of Steam Engineers.

ORGANIZED APRIL 27, 1886.

An Order of Engineesr for Engineers and Engineers only.

DECLARATIONS OF PRINCIPLES

Believing that ability will bring its full value in this country, this Order shall at no time take part in strikes, nor in any way interfere between employer and employees. Recognizing their identity of interests, it shall take no part in any project or enterprise that shall interfere with perfect harmony between them ; neither shall it be used for political or religious purposes.

These principles shall not be amended or repealed except by unanimous vote of the Order.

Any member who shall be guilty of violating the principles of the Order shall be expelled.

OBJECTS.

First.—To promote a more thorough knowledge in its members of theoretical and practical steam engineering.

Second.—To assist members to obtain employment.

Third.—To help the sick, injured and distressed and bury the dead.

Fourth.—To establish a Widows' and Orphans' Fund.

Fifth.—To help members who shall become Incapacitated from following the profession to obtain employment suited to their affliction.

Sixth.—To do our utmost to extend the license law throughout the United States.

Seventh.—To establish schools in which our members may study the highest branches of steam engineering.

MEMBERSHIP.

An applicant for membership must be an engineer between twenty-one and fifty years of age, and must be a white male citizen of the United States, of good moral character and be a believer in the Supreme Being, and be free from all physical infirmities.

He must have had three years' service in an engineering department, or if a machinist, or graduate of a technical institute, then, one year's service, in such department, and in localities where engineers are required by law to be licensed, they must have such license, and must satisfy the investigating and examining committees of the council to which he applies as to his character and ability.

LIFE MEMBERSHIP.

Engineers who have passed the age limit may be admitted to life membership. They must possess the same qualifications and pass the same examination as are required in the next proceeding clause : They shall be entitled to all rights and privileges of the Order except they cannot vote on financial questions or for the election of officers or be entitled to any sick or death benefits.

DIRECTORY.

The Publication Committee of "The Practical Engineer" desires that the Corresponding Engineers of all Councils of the American Order of Steam Engineers send the name of their Chief Engineer and their own name and address, together with the time and place of meeting to the Secretary of the Publication Committee immediately after each election of officers. Address J. C. McDowell, Secretary, in care of "The Practical Engineer," 1215 Filbert Street, Philadelphia.

SUPREME COUNCIL OF THE UNITED STATES

Supreme Chief Engineer.—Clifford P. Williams, 528 Greenwich St. Phila.

Supreme First Assistant Engineer.—Noah A. Pierson, Fidelity Building, Baltimore, Md.

Supreme Recording Engineer.—Jas. H. Stallings, 3082 Dillon Street, Baltimore, Md.

Supreme Corresponding Engineer.—J. C. McDowell, 1913 South Eighth St., Philadelphia.

Supreme Treasurer Engineer.—Geo. W. Richardson, 3728 Manazambe St., Wissahickon, Phila.

Supreme Senior Master Mechanic.—W. S. Price, Haddon Hall, Atlantic City, N. J.

Supreme Junior Master Mechanic.—Joseph T. Harris, 1611 Clybourn St., Milwaukee, Wis.

Supreme Inside Sentinel.—D. J. Stayton, 1613 West 4th St., Wilmington, Del.

Supreme Outside Sentinel.—H. L. McGee, Baltimore, Md.

Supreme Chaplain.—John T. Dodge, 21 Spring Lane, Boston, Mass.

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DELAWARE.

Deputy Supreme Chief Engineer, David J. Stayton, No. 1613 West 4th St., Wilmington.

Wilmington.

Delaware, Council, No. 1, meets every Wednesday at S. E. Cor. Fourth and King Streets. Chief Engineer, W. D. Wyatt. Corresponding Engineer, A. E. Deakyne, 406 Lombard Street.

LOUISIANA.

Deputy Supreme Chief Engineer, John W. Angers.

New Iberia.

Evangeline Council. Chief Engineer, John B. Lanaier. Corresponding Engineer, W. J. Maynard.

MARYLAND.

Baltimore.

Deputy Supreme Chief Engineer, A. J. Deidrich, 226 North Caroline St., Baltimore, Md.

Maryland Council, No. 1, meets 2d and 4th Fridays in Royal Arcanium Hall. Chief Engineer, J. C. W. Schrier. Corresponding Engineer, Wm. S. Smith, 116 W. Lee Street.

Energy Council, No. 2, meets every Wednesday of each month in Bauer Hall, Cheaspeak and Elliott Sts. Chief Engineer, Philip A. Kirkwood. Corresponding Engineer, Jos. H. Stallings 3082 Dillon St.

MASSACHUSETTS.

Deputy Supreme Chief for Eastern District, W. E. Packard, Whitmann.

Boston.

Boston Council, No. 4, meets 2d and 4th Thursday of each month in Templar Hall, 724 Washington Street. Chief Engineer, Harry G. Black. Corresponding Engineer, Wm. T. A. Faulkner, 41 Worcester St.

Orange.

Orange Council, No. 9, Meets 2d and 4th Fridays. Chief Engineer, Chas. Gartrell; Corresponding Engineer, Fred. L. Hale.

Rockland.

Old Colony Council, No. 14, meets second and fourth Saturdays in the American Foresters' Hall. Chief Engineer, E. H. Naylor. Corresponding Engineer, Chas. W. Alden, Box. 642 North Abington.

NEW JERSEY.

Deputy Supreme Chief, F. O. Garrison, Bridgeton, N. J.

Perth Amboy.

Stevens Council, No. 1, meets third Saturday, at Water, near Lafayette Street. Chief Engineer, Lawrence Oliver. Corresponding Engineer, James H. White.

Camden.

Camden Council, No. 3, meets every Thursday evening at N. E. corner 2d and Federal Street. Chief Engineer, S. R. Middleton. Corresponding Engineer, C. H. Pfeiffer, 571 Berkley St.

Atlantic City.

Atlantic City No. 4 meets every Tuesday evening at Merchants, Cor. Atlantic and New York Avenues. Chief Engineer, R. Endicott. Corresponding Engineer, W. S. Price, Haddon Hall.

Bridgeton.

Bridgeton Council, No. 5, meets every Friday. Chief Engineer, David Sellers. Corresponding Engineer, Francis O. Garrison, Bridgeton, N. J.

Millville.

Millville Council, No. 6, meets every Saturday, 7.30 p. m., in G. A. R. Hall, East Main St. Chief Engineer, Geo. Esabel Corresponding Engineer, Lewis Doughty, 604 Mulberry Street.

NEW YORK.

Syracuse.

John E. Sweet Council, No. 6, meets Monday, Room 23, Nottingham Block, East Washington Street. Chief Engineer, John Cunningham. Corresponding Engineer, S. A. Steel, 311 Orange street.

PENNSYLVANIA.

Grand Chief Engineer, Hiram Trout, 1105 North Tenth street, Reading, Pa. Grand Corresponding Engineer Frederick Markoe, 931 Orianna street, Philadelphia.

Philadelphia.

Deputy Grand Chief for Western Pennsylvania, A. D. Hamilton, 2025 Forbes Street, Pittsburg, Pa.

Germantown Council No. 22 meets every Wednesday evening at Main and Seymour Streets, Germantown; Chief Engineer, John P. Rickards; Corresponding Engineer, Frank MacIndoe, 3529 Ainslie St., Falls of Schuylkill, Philadelphia.

Welcome Council, No. 2, meets every Friday, N. W. Cor. 12th Street and Columbia Avenue. Chief Engineer, Paul Pieling. Corresponding Engineer, L. D. Woodington, 2428 N. Bancroft St.

Kensington Council, No. 3, meets every Thursday, at A. P. A. Hall, Frankford Avenue and Master St. Chief Engineer David J. Ezrah. Corresponding Engineer, Charles Fournier, 3115 Richmond St., Philadelphia.

Southwark Council, No. 4, meets every Monday, at corner of Reed and Eighth Streets. Chief Engineer, Joseph Hynes. Corresponding Engineer, J. C. McDowell, 1913 S. 8th Street.

(Continued on page 28.)

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DIRECTORY OF COUNCILS CONTINUED.

Philadelphia Council, No. 7, meets every Wednesday, at Kenny's Hall, N. W. cor. Broad and Filbert Sts. Chief Engineer, Jas. J. Murphy. Corresponding Engineer, W. S. Wetzler, 3707 Aspen St.

Manayunk Council, No. 9, meets second and fourth Friday evenings in Temperance Hall. Chief Engineer, Richard Wallace. Corresponding Engineer, John Clevenger, 211 Lofty Street.

Helping Hand Council, No. 12, meets every Thursday evening at Kensingon Ave., and C Streets. Chief Engineer, Edward Laurence. Corresponding Engineer, Frank McHugh, 2503 Tulip St. All correspondence should be addressed direct to the Council.

Municipal P. F. D. Council, No. 20, of Philadelphia, meets the second Thursday of each month at Odd Fellows' Hall, Third and Brown Streets. Chief Engineer, Frederick Markoe. Corresponding Engineer, Walter Meyers, 1211 North Howard Street.

Pittsburg.

Iron City Council No. 21 meets every Saturday at 1070 Fifth Avenue. Chief Engineer, Phillip W. Sutton. Corresponding Engineer, F. C. Rose, care of St. Paul's Orphan Asylum, Idlewood, Pa.

Girardville.

Girard Council, No. 8, meets every Tuesday evening at O'Neill's Hall, 2nd and Ogden Sts. Chief Engineer, Jacob Weber. Corresponding Engineer, M. J. Carey, Lock Box 214.

Allentown.

Lehigh Council, No. 15, meets every Wednesday evening at 639 Hamilton St. Chief Engineer, Wm. R. Smith. Corresponding Engineer, A. P. Driesbach, 728 Chew Street.

Pottstown.

Pottstown Council, No. 14, meets first and third Saturday evening at P. O. S. of A. Hall. corner High and Hanover Sts. Chief Engineer, Joseph Rhoads, Corres., Engineer, H. L. Shirey, 362 Cherry St.

Reading.

Progress Council, No. 13, meets every Saturday evening at Diebert Hall, 9th and Penn Sts., Room 4. Chief Engineer, Geo. W. Miller. Corresponding Engineer, Frank S. Miller, 3 W Franklin St.

Chester.

Delaware County Council, No. 6, meets every Wednesday evening in the Carpenter Hall, 6th and Wall St. Chief Engineer, John Canavan. Corresponding Engineer, E. E. McCoy, 2222 West 3d Street.

York.

York Council, No. 16, meets every Wednesday evening in the Jordan Block. Chief Engineer, A. L. Bair. Corresponding Engineer, Walter H. Long, 23 East Philadelphia Street.

Harrisburg.

Capitol City Council, No. 17, meets every Tuesday evening in Red Men's Hall, Market Street, above Second. Chief Engineer, B. H. Shafer. Corresponding Engineer, S. Filson, 1126 Market Street.

Columbia.

Columbia Council, No. 18, meets every first and third Saturdays, in Odd Fellows' Hall. Chief Engineer, Ruben Beard. Corresponding Engineer, W. J. Courtney, 804 Walnut Street.

Sunbury.

Sunbury Council, No. 19, meets every second and fourth Saturday in Zartman's Hall. Chief Engineer, S. E. Lees. Corresponding Engineer, Ed. Schrieber.

WISCONSIN.

Deputy Supreme Chief Engineer, Joseph P. Harris, No. 1611 Clybourn Street, Milwaukee.

Milwaukee.

Washington Council, No. 1, meets every Saturday at 207 Grand Avenue. Chief Engineer, J. B. Chambers. Corresponding Engineer, James A. Rigby, 136 Reed Street.

Clifford P. Williams Council, No. 2, meets every Thursday evening 298 4th Street. Chief Engineer, David T. Richardson. Corresponding Engineer, Jas. T. Harris, 1611 Clybourn Street.

TENNESSEE.

Deputy Supreme Chief Engineer, John B. Mullen, 826 Central Ave., Nashville.

Nashville.

Enterprise Council, No. 1. meets every Friday evening in the Twin Building on Cedar St. Chief Engineer, J. J. Johnson. Corresponding Engineer, Jno. B. Mullen, 209 Jackson Building.

OREGON.

Deputy Supreme Chief Engineer, Nat Freese, Grant's Pass, Oregon.

Grant's Pass.

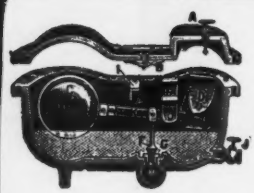
Oregon Council No. 1. Chief Engineer, William H. Kenny. Corresponding Engineer, Nat Freese. Meets every first and third Saturday. A. O. U. W. Hall, Main St.

TEXAS.

Deputy Supreme Chief Engineer. S. A. Bisbery, care of Cotton Compress and Warehouse Co., Galveston.

Galveston.

Galveston Council No. 1 meets every second and fourth Tuesday evening at Engineers Hall, So. West corner 22nd and Strand Streets Chief Engineer, Max Levy; Corresponding Engineer A. L. Bradford, Union Depot.



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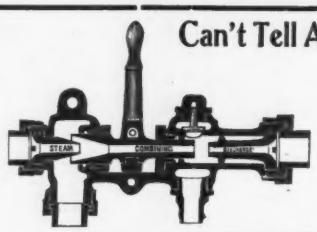

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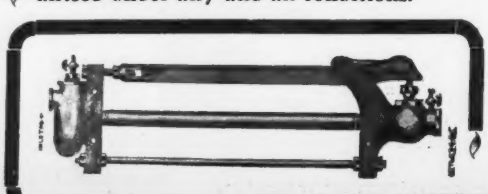

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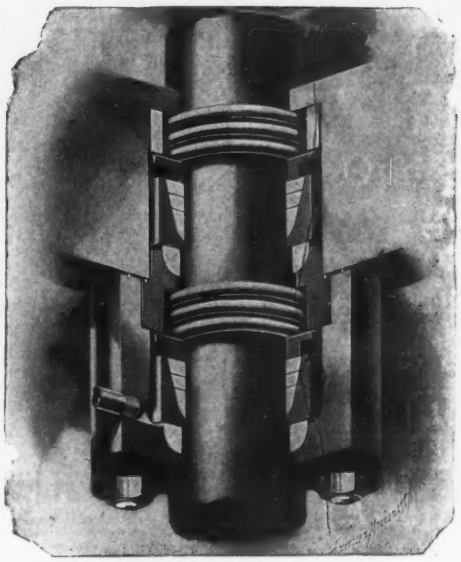

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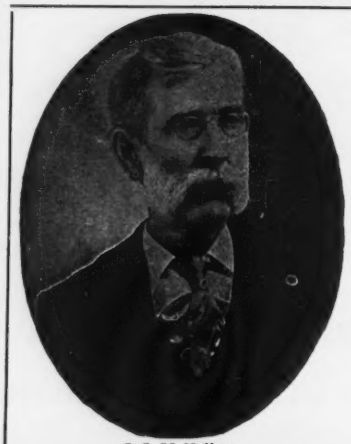

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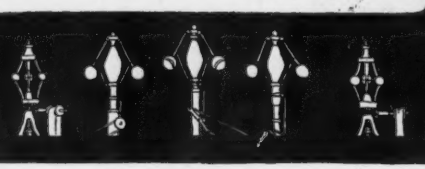

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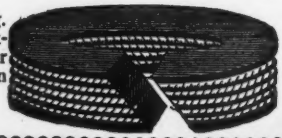

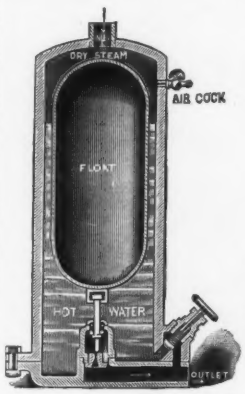

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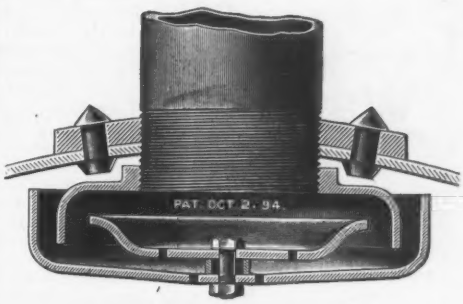

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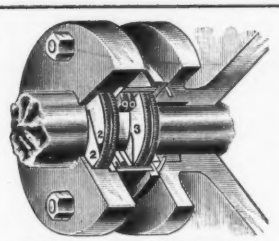

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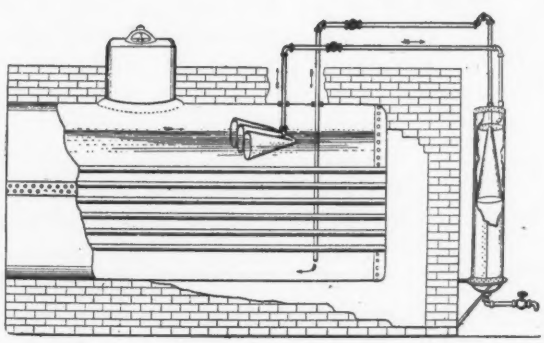

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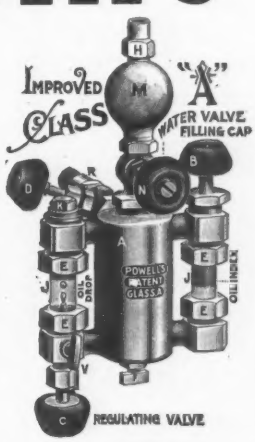

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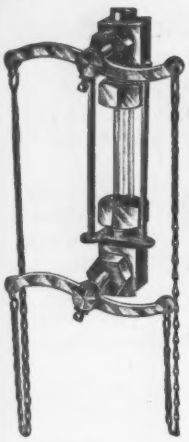

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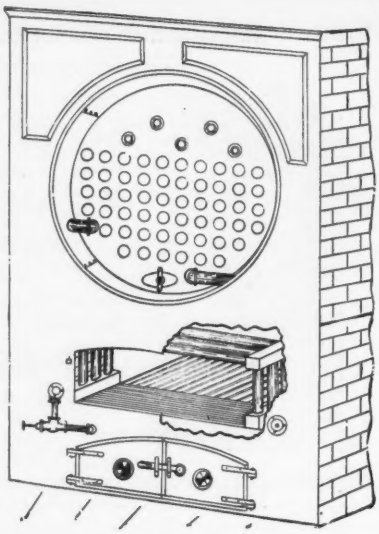

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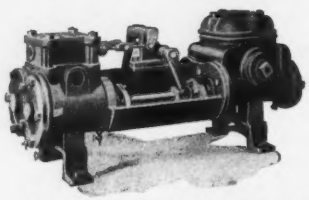

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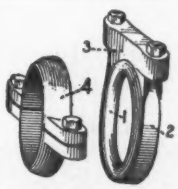

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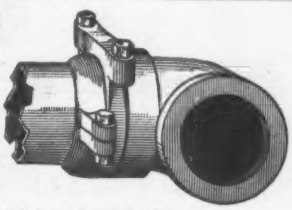

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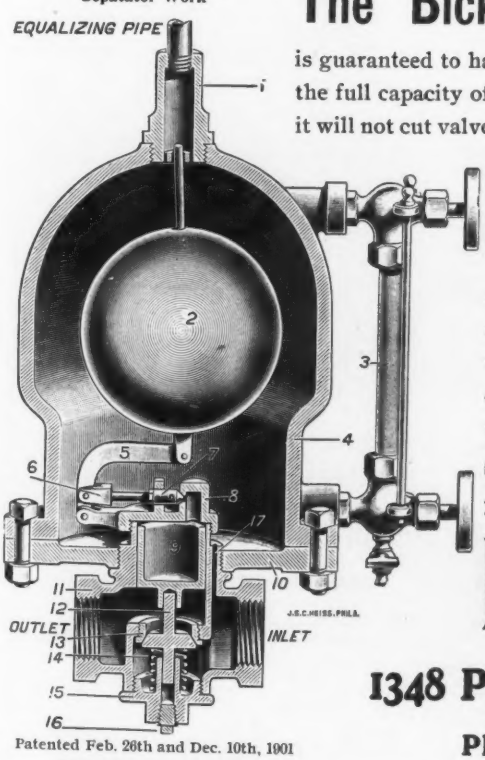

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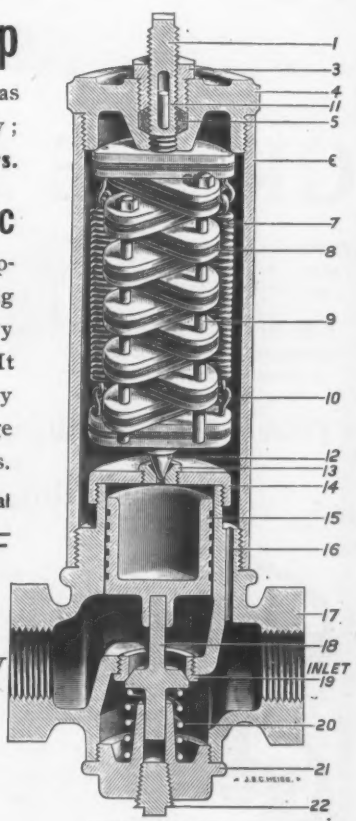

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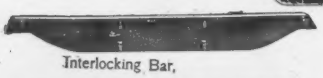

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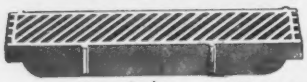

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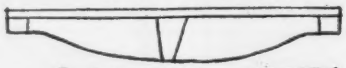

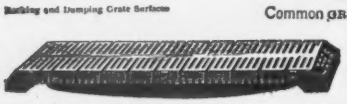

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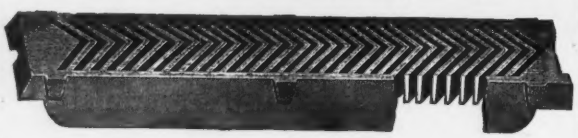

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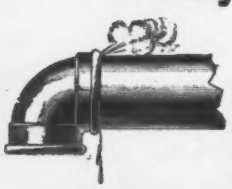

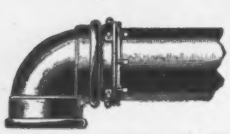

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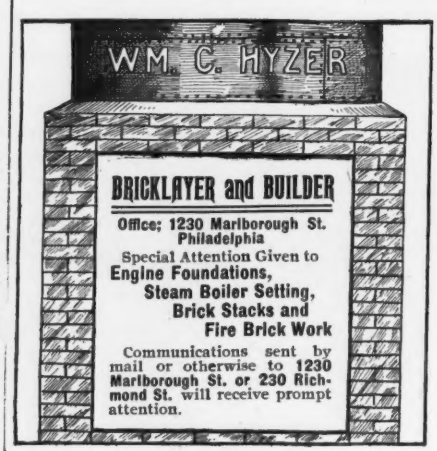
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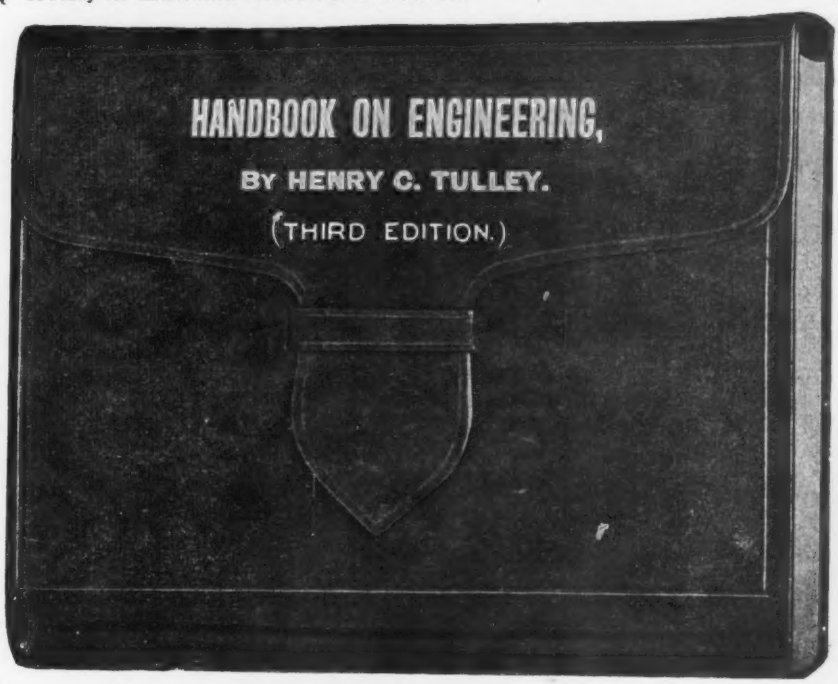

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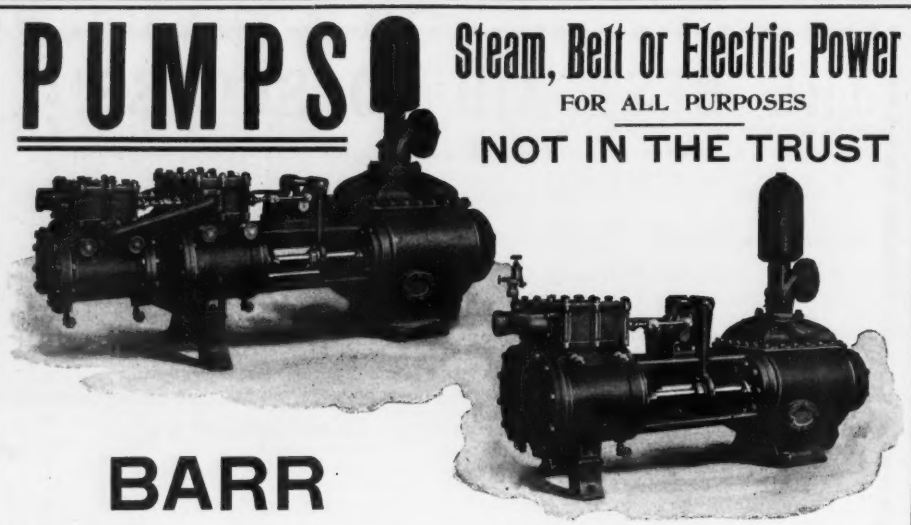

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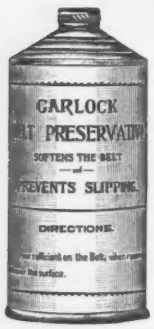

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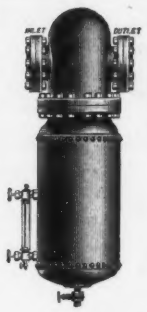

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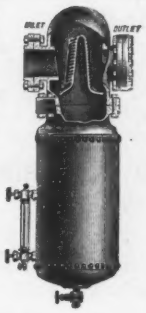

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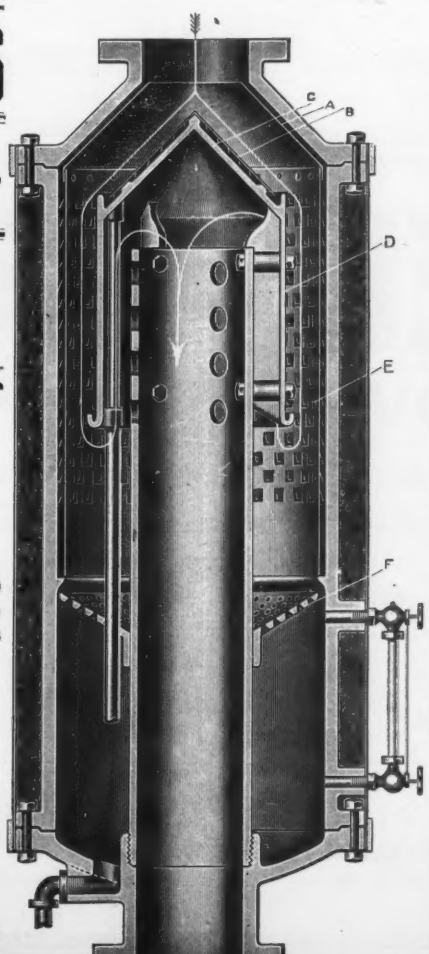

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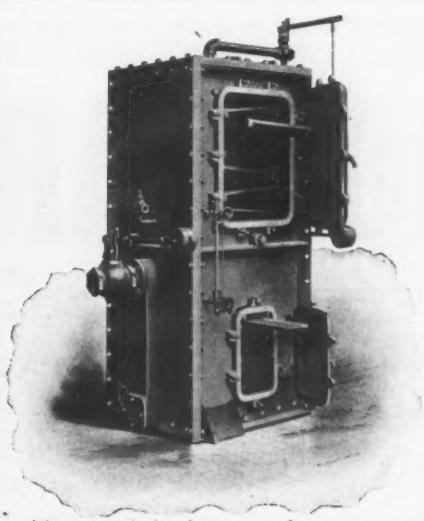

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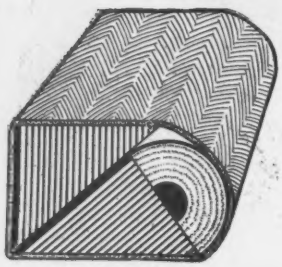

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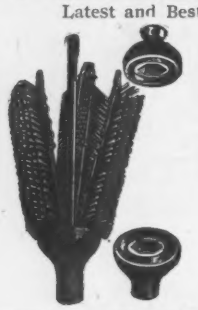

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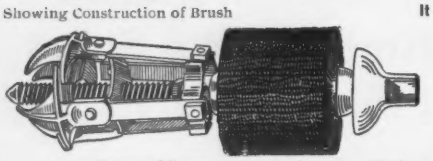

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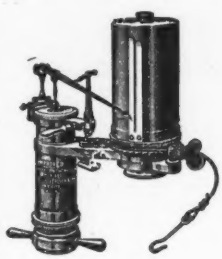

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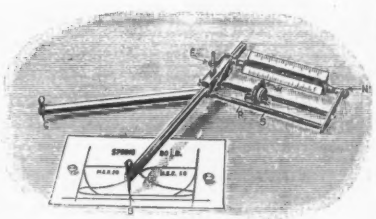

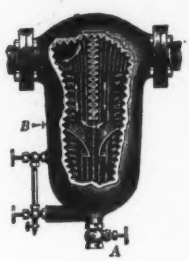

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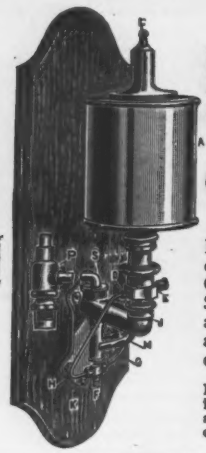

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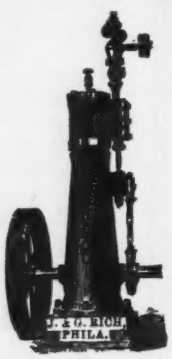

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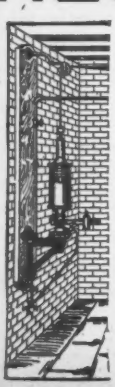

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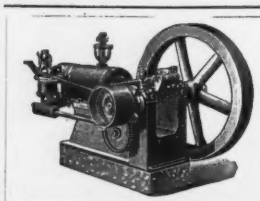

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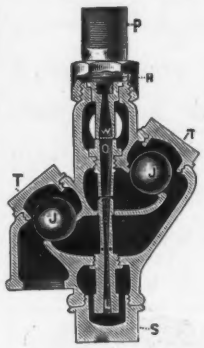

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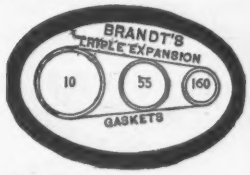

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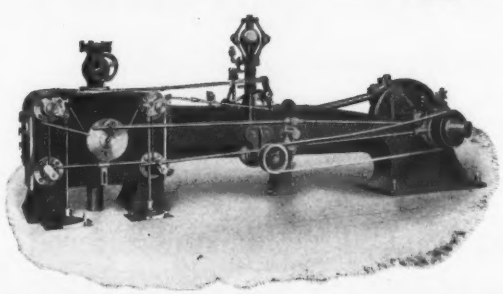

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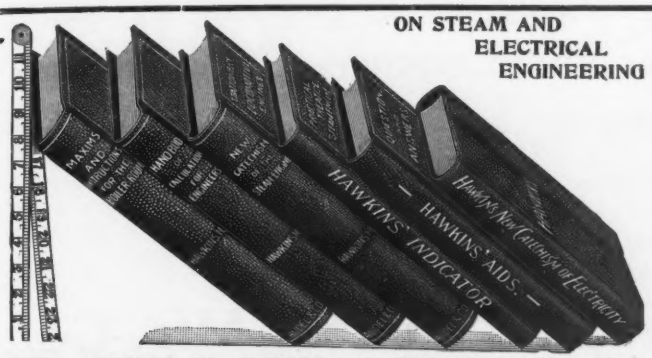

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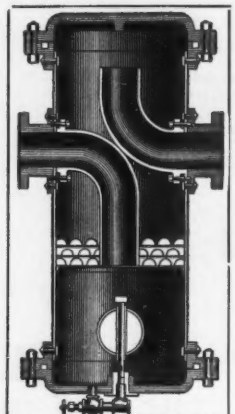
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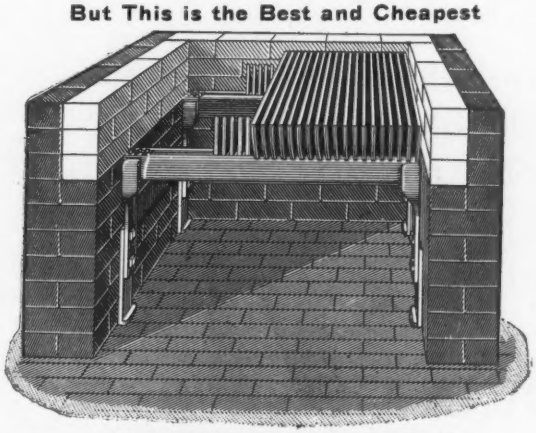

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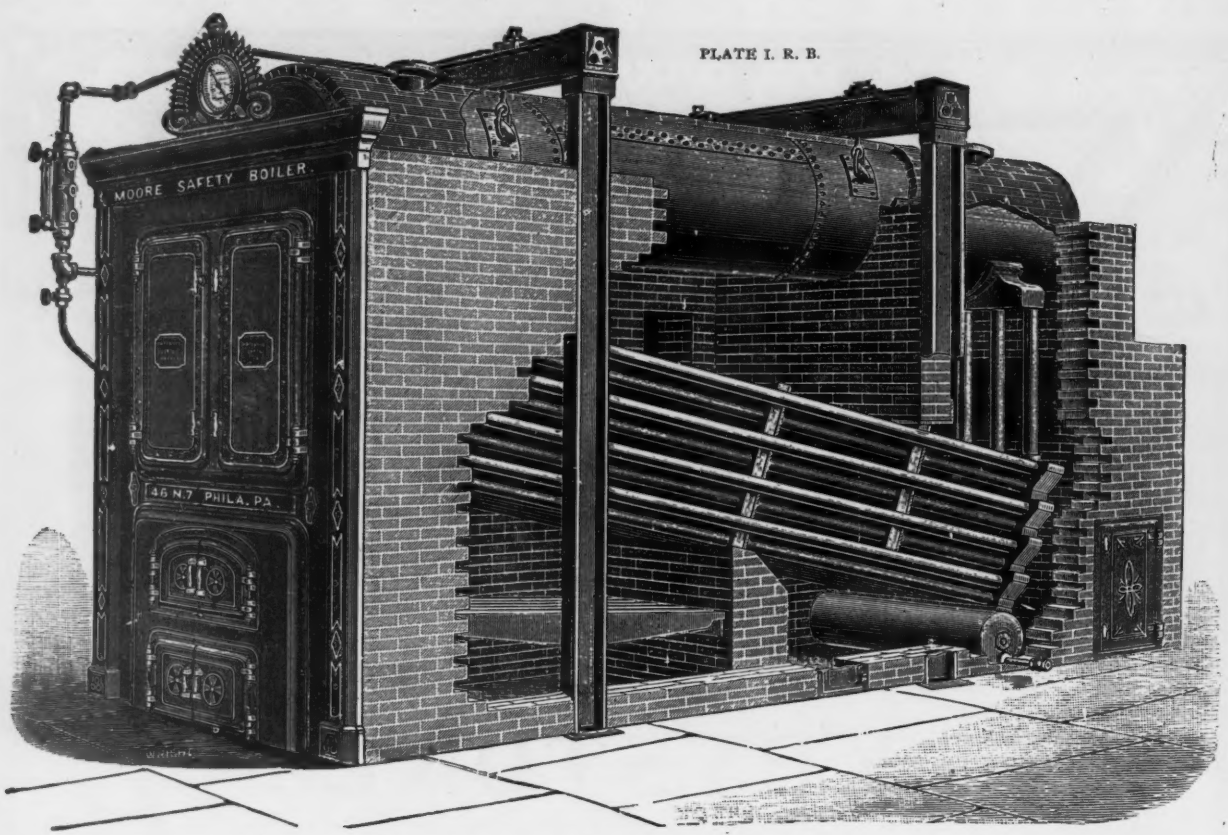

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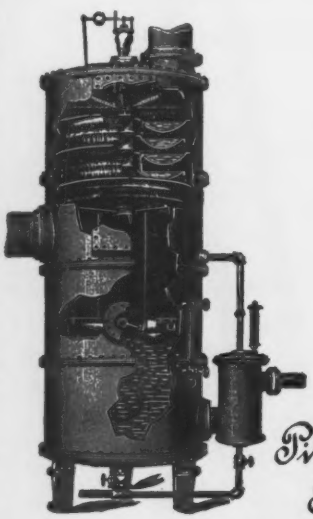

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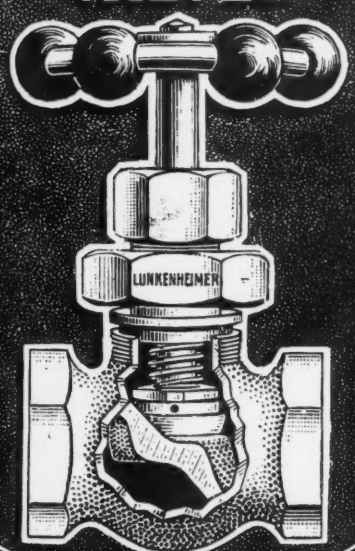

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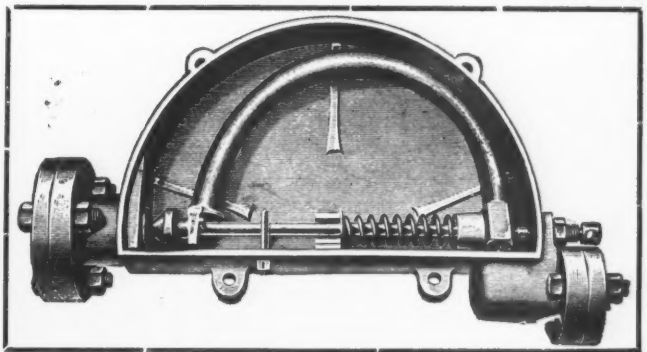


Who is Hurt?

WE don't mind imitations of the **HEINTZ** trap. We are not the ones hurt by them. We simply accept the compliment—and wait.

It's easy to make a trap that looks just like the **HEINTZ.** Many have tried it—and their traps are gone and forgotten. Other imitations are made under various names, being sold now to people who don't know that the essential secret of Heintz efficiency is in the sensitive compound that actuates the spring.

When the buyers have found them out, and spent good money to replace them with **HEINTZ** Traps, no doubt there will be a fresh crop of imitations.

And who will be hurt?

The HEINTZ Steam Trap is made in nine sizes; capacity 1 to 240 gallons a minute. Guaranteed for one year.

WILLIAM S. HAINES CO.

136 SOUTH FOURTH STREET

PHILADELPHIA

HF

'96 Jenkins Standard '96 Packing '96

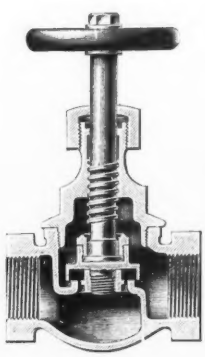
The Perfection of Joint Packing. Do not accept unless it bears our Trade-Mark as shown in the cut.

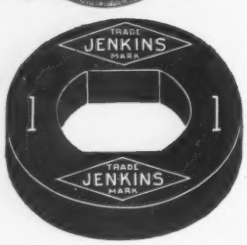
Use Jenkins '96 Sheet Packing on the worst joint you have, and if it is not what we claim we will refund the money.

JENKINS '96 PACKING has stood the most crucial tests under all conditions of service with steam, oils, acids, ammonia and the like, and in no case has it failed to make a perfect joint when properly applied. Can be placed in a joint either hot or cold, and will make joint instantly. Full steam pressure can be turned on at once when joint is made, it does not require to be followed up and will not blow out. It vulcanizes in place and forms a compound that will not rot or burn out, but will last as long as the metals which hold it. It joins with rough surfaces equally as well as when they are faced. **Jenkins Standard '96 Packing** weighs less than most joint packings. When compared with equal sizes of other packings sold at a lower price per pound, it will be found to cost less per square yard.

Jenkins Brothers' Valves

Designs, workmanship and materials of the highest standard throughout. Every valve inspected and tested before leaving the factory. Made in all styles and sizes, both brass and iron.





Jenkins Discs

Do not be deceived when you are offered discs "just as good" or better than the Jenkins, as many worthless imitations of our discs are on the market. We are the original manufacturers of this class of goods, and we have tried to maintain the high standard in which they are held by steam users throughout the world. Copper, Lead, Babbitt and all kinds of metal discs have been experimented with for the past twenty years, and in almost every instance, when under the action of steam, they become oxidized and hard, so that chip or scale getting between the disc and seat causes a leak, which necessitates regrinding. Insist on having the genuine Jenkins Discs; the difference in cost will not pay you to experiment. If you wish discs for any particular purpose, write to us; we can experiment cheaper for you than you can for yourselves. **Jenkins Discs will stand steam, oils or acids. We have special soft discs for cold water.**

Jenkins Brothers' Pump Valves

Adapted to every pumping requirement, these valves are especially suited for pumping hot water, syrups, beer and other destructive fluids; also muddy and gritty water. When rubber valves have been found useless, these valves have given entire satisfaction.

For mining and high-pressure service, also for elevator pumps, Jenkins Brothers' No. 88 Pump Valves are in use under 450 pounds pressure, and are proving themselves equal to every requirement.

We also manufacture a fine grade of Soft Rubber Valves for cold water and air service.

When ordering valves please state for what purpose you desire to use them.

Jenkins Brothers' Valves, Jenkins '96 Packing and Rubber Specialties received the Highest Awards at the Pan-American Exposition

All our different specialties are stamped with Trade Mark.

Write for Catalogue

JENKINS BROTHERS'

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